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TABLE OF LEADING ARTICLES.

Separate High-Service Pumping Stations........ 695
A British Opinion of the International Railway Congress 695
Design of Highway Bridges for Ultimate Electric Car Service 696
New Forest Reserves 696
Cement Joints for Gas Mains........ 697
Masonry Dam for the Granite Springs Reservoir, Cheyenne, Wyo. (Illustrated.) 698
The Management of the Roxborough Water Filters, Philadelphia. (Illustrated.) 702
Steam Turbines in America........ 703
The Accident in the Gunnison Tunnel........ 705
The Platform Shelters of the New Lackawanna Terminal at Hoboken. (Illustrated.) 706
The Evolution of the Practice of American Bridge Building 707
Sewage Purification Plant at Charlotte, N. C. (Illustrated.) 711
Extensions of the Worcester Sewage Disposal Works. (Illustrated.) 713
The Erection of a Large Gasometer. (Illustrated.) 715
Test of Parker Water-Tube Boilers. (Illustrated.). 716
The Double-Track Austerlitz Bridge, Paris. (Illustrated.) 717
Smoke Prevention and Mechanical Stokers........ 719
Book Notes 719
Umbrella Trainsheds 720
Cement Briquettes 720
California Oil Asphalt 720

Separate High-Service Pumping Stations.

In almost all cities the business district lies lower than the ground occupied by residences. Railroads nearly always choose valleys instead of ridges for their location, and as manufacturing and commercial interests keep close to the highways of commerce, it follows that, even in the cities having no frontage on navigable waters, the abiding place of these interests will almost invariably be found at a comparatively low elevation. As the city develops, the growth of its business is provided for partly by the erection of higher buildings and partly by expansion into the older and lower residential districts, while the desire for fresh air, more room, and freedom from noise and smoke directs the march of the home builders constantly toward higher ground.

In the course of time, either as a result of increased consumption or because the new territory lies too high for the pumping plant and distribution system as originally planned, the mains fail to afford adequate pressure to these ever-increasing residential districts. If increase in consumption be the only difficulty, it may be met by increasing the supply to and the capacity of the pumps at the main station, and by laying more and larger water mains. If, however, the new addition be located so high that the city pressure is inadequate—limited as it may be by the strength or capacity of the mains, the power of the pumps, or the elevation of an existing reservoir—the solution of the problem may not be so simple.

In a case in point, the existing reservoir is on the highest available ground and the growth of the city is fast approaching the reservoir site. The distribution system, constantly reaching out from the business center toward the high ground, is nearing its limit of pressure, and at the same time surrounding the reservoir, which will ultimately become the center of a large suburban territory. There is a large reserve of capacity in boilers and pumping engines at the pumping station, which is only 6,000 ft. from the reservoir tract. In this case it will probably be found best to build a tower and tank on the reservoir tract, and to install at the main pumping station two duplicate pumping units, to be connected to the tower and tank by a force main of suitable size. Each pumping unit will probably be a two-stage turbine pump direct connected to a steam turbine, and will take its suction from the existing low-service force main at city pressure, and discharge into the new high service force main at a pressure great enough to fill the tank.

It often happens, however, that the residential territory to be supplied lies so far from the existing pumping station that the cost of the new force main which would be required for an installation like the one just described would be prohibitive. For instance, in a certain city having the direct-pressure system without reservoir the pumping station is located near the western city limits, while east of the city, at an elevation higher than any point within its boundaries, and seven miles from the pumping station, a new residential addition is being developed. The friction in the mains is already, in summer months, so great as to reduce materially the pressure east of the center of the city; and although a large new force main is being built to the center of distribution, the new territory lies so high that some other additional means must be employed to insure it adequate pressure.

This case, typical of many others, calls for a separate pumping station, taking water from the existing mains and "boosting" it at higher pressure into the mains to be laid through the new addition. The booster pumps will have to be driven either by a steam engine, an internal combustion engine, or an electric motor taking current from some local electric company.

In the "Journal" of New England Water Works Association, March, 1899, Mr. Freeman C. Coffin presented some interesting comparisons of the cost of pumping water by internal combustion engines burning gas, gasoline or oil, and by steam plants using coal. Assuming that the plant installed in each case was of sufficient capacity to pump the daily consumption in one ten-hour shift, Mr. Coffin showed that the cost of supplies and repairs, attendance, and interest and depreciation at 7 per cent. per annum, were less for the internal combustion engine than for the steam plant, while the cost of fuel would usually be much less for the steam plant. Interpolations can be made in Mr. Coffin's tables and diagrams which show that with oil at about 8.1 cents per gallon, gasoline at 9 cents per gallon, or gas at 62 cents per 1,000 cu. ft.. the total cost of pumping 350,000 gal. per day against a head of 210 ft. will probably be about the same with an internal combustion engine as with a compound condensing duplex direct-acting steam pumping plant with coal at $4 a ton. This total cost, according to Mr. Coffin, would be about $3,200. For smaller capacities, the internal combustion engine, and for larger, the steam engine, will be found the more economical.

Assuming that electric power may be purchased from a local company, a comparison of its cost with the foregoing will be next in order. The conditions call for a plant having a water-horse-power of about 31, and assuming a combined efficiency of 68 per cent. for motor and turbine pump, the input to the motor would be about 46 electric horse power. The cost of the plant, installed complete, may be put at $3,000. Interest at 4 per cent. and depreciation at 10 per cent. would be $420. The labor cost would be comparatively very low, so that $380 would be ample for attendance, repairs and supplies, making a total of $800 per annum for all costs except that of power. Deducting $800 from the annual cost of $3,200 for the engine-driven plants, there remains $2,400 available for annual cost of electric power. To compete on equal terms, the local electric company would have to furnish power at the switchboard of the pumping station at about $52 per horse power per annum on the basis of 10 hours use per day.

The solution of such problems should only be attempted after careful study of the conditions, but the above notes indicate what an attractive field for the skill and experience of the designing engineer they present.

A British Opinion of the International Railway Congress.

The leading article in a recent issue of the engineering supplement of the London "Times" gives the views of a British delegate to the International Railway Congress. He is frankly of the opinion that the methods and procedures of the organization are foreign to the Anglo-American spirit, howeved well suited they may be to European systems of conducting railway affairs. The opinions of this critic are the same, in some respects, that were expressed at the time of the Congress by this journal. The main benefit to be derived by a delegate lay in the opportunity for learning the reasons for the different methods of accomplishing the same result in various countries, for forming a personal acquaintance with those in attendance, and for inspecting American equipment under the most competent guidance.

This delegate criticises very strongly the wandering, illogical and unsatisfactory character of many of the papers. The best papers were valuable, mainly, because they summarized the views of railway practice under widely divergent conditions in many countries. The debates were often rambling and, being conducted in two languages, were hard to follow. The sessions as a whole were "distinctly disappointing, so far as any practical good is concerned. Many of the 'conclusions' may be described as carefully sifted platitudes, intended, so far as practicable, to convey as little offense as possible to quarters where decided views on questions of policy, of traffic, of rates, and of mechanical applications are held." Those readers who recall the "conclusions" printed in this journal a few weeks ago will agree that this criticism of their character is fully warranted.

Another feature of the Congress that did not find favor with this delegate was the attempted secrecy of the sessions. It was merely nominal, of course, for any technical journal that so desired could have readily obtained a report of the discussions that took place behind the guarded doors; the discussions, in most cases, were not worth the bother, however, as the official reports showed. On these latter, the British delegate makes the following comment: "The official reports, as published from day to day in the journals of the Congress, were ridiculously inadequate, especially for the important technical journals of Europe and America, and the exclusion from the meetings of the able contributors on engineering subjects to these publications seems, from both a British and an American point of view, to have been the greatest possible mistake. . . . By excluding the technical press the Congress lost an opportunity of making its work known, which nearly all the British and American delegates who have been consulted on the subject have regretted." As a matter of fact, this exclusion was merely nominal, as before stated, but the spirit shown, which is the basis of this criticism, is certainly foreign to the policy of countries where railways are not a part of the governmental machinery.

The important lesson of the Congress is its impracticability. Hereafter the discussions will be in German as well as in French and English. Consequently they will be, in a measure, unintelligible without interpretation to most of those in attendance. Over half of the railway mileage of the world is owned and managed by English-speaking people. These lines are operated under a great variety of conditions, and the suggestion made by this British delegate for an Anglo-American Railway Congress is by no means new. The International Congress is doubtless well suited for European conditions, but it will never change the fact that the practice of one country cannot be altered so as to suit another. The organization is too complex and too little adapted to permit a definite stand to be taken on any disputed question to accomplish very much. On the other hand an association of railways under the control of English-speaking people would be free from most of the defects above outlined.

Design of Highway Bridges for Ultimate Electric Car Service.

There is no field of engineering construction which has passed through more vicissitudes or has been more discussed with a view to improvement in design than iron or steel highway bridge building, and none has probably needed it more. In the early days of iron highway bridge construction nothing was more common than gross evasion of responsible design by deliberately ignoring even the magnitude of actual loading to be carried on completion of a structure, to say nothing of wretched quality of material used, and the worse designing of details. This kind of construction has not altogether disappeared, although it is found only in a comparatively few rural localities. In most places where there is considerable population and extended business interests carrying with them better administration of public affairs, highway bridge design has received more nearly the attention which its importance demands. In many localities, whose numbers are fortunately constantly increasing, the designing of bridges for street traffic is a subject of as thorough engineering consideration as the design and construction of railroad bridges on the best managed lines in the country. There are even standard highway bridge specifications drawn by prominent engineers to meet the requirements of a large and constantly growing field of construction. All this is strongly significant evidence of a substantial advance in the designing of highway bridges and it may be thought that there is nothing further to be desired or advocated in connection with that class of work. That, however, is not the case, as there is an important feature of the matter which has been created by comparatively recent developments.

Up to approximately ten years ago the character of traffic on any given highway, whether in the country or in urban or suburban districts, was fairly well established, and the loads for any iron bridge to be built on them could be predicted with sufficient closeness to insure against overloading for many years. There were few cases where the possibility of development of heavy street car service was not exceedingly remote, although instances were frequent where a light street car service could reasonably be foreseen after a period of years. Such heavy electric service as is now found, even in some country districts, was scarcely thought of anywhere. Under such circumstances it was frequently necessary to design roadway bridge structures for much heavier moving loads than they would be required to carry immediately on completion, but about the most anticipated at that time was the provision, so many times made for a heavy steam road roller. This did not add much to the weight of the iron portion of the floor system and little if any to the trusses, making it advisable to build the bridge at the outset with full sections of its members for the heaviest loads ever contemplated. All this is now radically changed in many quarters.

The extension of trolley lines, into not only suburban but country districts, has been so rapid that there are few neighborhoods in prosperous parts of the country where trolley transportation may not be expected well within the life of any properly designed highway bridge. Already the extensions of such traffic have far surpassed the anticipations of half a dozen years ago, and now it is a pretty poor agricultural district, even, that may not look for its electric line within ten or a dozen years. As any highway structure ought to be so designed as to provide for the duties of at least twenty-five or thirty years in the future these developments of electric street traffic ought to be most carefully considered in many, if not the great majority of roadway bridge designs where no such traffic now exists. It is obviously uncertain what weight of electric cars the next quarter of a century may produce, but that is a matter on which the engineer's judgment may properly be brought to bear. One thing is certain, and that is an extraordinary growth of electric roadway transportation for which provision must be made under the proper administration of public roads. The weight of electric cars for a given density of traffic is now well known and a suitable estimate of weight for a future period of years can at least be based upon past records, and that is sufficient for the purposes of good bridge design for future use. The time has fully come for the inclusion for corresponding provisions in the specifications for such structures.

Large populations, both centered and diffused, have already been built up largely by the stimulating influence of trolley lines, and corresponding results on larger scales are absolutely certain to be reached under similar but stronger influences hereafter. Engineers intrusted with the designing of highway bridges must therefore carefully consider provisions for future electric car service. This is particularly true for the trusses, which should certainly be designed and built for the future electric service. The increased sections of members will not add to their weight or cost to a serious extent. The floor systems, however, need not be designed at once for the future heavier traffic. Timber, rather than iron, may be used for the first duties of the structure largely or entirely. These temporary floors may reasonably be designed for relatively light initial traffic, so that when displaced by the future heavier floor system the additional cost will be so small as to be unimportant. This feature of the present and future highway bridge design is based upon conditions of weight whose importance is rapidly increasing, but which have not heretofore received the thoughtful attention that the actual demands of the future require.

The New Forest Reserves.

The President has recently set aside nearly three million acres of land for a purpose that will appeal strongly to engineers. In Central Idaho there is a tract of 1,281,000 acres of mountainous country covered largely with forests, where the snowfall is heavy and the rains amount to little. The cold, late spring and the protection of the forests prevent the rapid melting of the snow, and on this account the run-off of the large streams heading in this tract is more even than that of most mountain rivers. In Southwestern Colorado, from the Needle Mountains to the New Mexico line there are 1,463,000 acres, covered with trees and, on the highest portions with grass and weeds that exert a great influence on the run-off. In the district surrounding this mountainous tract irrigation is the most important element in the life of the farmers, and the necessity of conserving and regulating the natural run-off is imperative.

Both these great tracts have been made forest reserves and henceforth their administration will be under the direction of the chief of the Bureau of Forestry. In both of them there is excellent grazing for sheep, and they will be permitted on all the suitable land for this purpose. The grazing will be under government control, however, a thing which will be gladly welcomed by most of the settlers, for the great flocks of sheep now raised are usually detested like locusts by most of the farmers and cattle men. The sheep destroy young trees and ruin a cattle range, and they must accordingly be carefully guarded; on the other hand their commercial value renders it desirable to surround the industry with only necessary regulations enforced impartially. The protection afforded to the forests against the wasteful tree slaughtering of the lumberman is as important as the regulation of grazing and perhaps more so. The government is understood to contemplate the sale of the mature timber, but it is hardly necessary to say that the cutting will be done according to a program which will insure the perpetuation of the forest.

The greatest good to come from the government control of these forest lands will probably be the regulation of the run-off and the protection of irrigation enterprises dependent on the waters from these mountain forests and pastures. The introduction of the methods of sound forestry may be reasonably expected to keep the run-off the same as in the past, and thus ensure the utilization to the full of large tracts of land where farming without irrigation is precarious or impracticable. That the stripping of mountain lands of their forests is followed by alternate floods and droughts is too well proved to need comment. This opinion is occasionally assailed, it is true, and we must expect to hear about the dried up mill streams of New Hampshire, in districts having more timber now than when the mills were running, until some investigator carefully determines the truth regarding these exceptional cases of apparent departure from the general law. Consequently it is gratifying to record the promptness with which the President has sealed against heedless or ignorant destruction two great tracts which will hereafter be administered with equal regard to the interests of the nation, the lumberman, the shepherd, the farmer and the irrigator. It is fortunate, moreover, that the work of planning the management of these tracts will come under the charge of an official having the qualifications for the work of the present chief of the Bureau of Forestry.

Cement Joints for Gas Mains.

The most troublesome feature connected with water and gas pipes is the proper filling of the joints. The work is generally done in a trench where the space available for the men is very limited, and the temptation to scamp the work on the lower part of the pipe, where the inspection is rarely thorough and the difficulties of making the joint are greatest, is too strong to be resisted by some men. In the case of cast-iron mains with ball and socket joints, lead is employed almost exclusively for water mains, while for gas mains cement and lead seem to be about equally favored. Inasmuch as a cement joint can be made more quickly, more satisfactorily and at a lower cost than a lead joint, there is a growing tendency to employ it, and among the companies which have reached this decision is the Laclede Gas Light Co., of St. Louis. This company received a notification, however, to discontinue the use of these joints on the ground that they would undoubtedly leak in the future, and it would be necessary to tear up an unnecessarily large number of streets to make repairs. Doubtless another reason for this prohibition was a fear lest cement would allow so much gas to escape that the asphalt pavements on some of the streets would be seriously injured, for such gas rots asphalt rapidly. The experience of the company with cement joints had been so satisfactory, however, that it resolved to make a careful investigation to determine their properties, and this has proved so favorable to cement as to deserve attention.

The experiments, which were described at a recent meeting of the Western Gas Association by Mr. Jacob D. von Maur, were made with pipes jointed up on the surface and also with lines which were already laid for regular use. It is unnecessary to record in this place the details of the tests, which showed that the joints would withstand interior pressures running over 100 lb. and were not injured by deformations of the pipe line exceeding in severity any that would occur in practice. It should be stated that all the joints were comparatively new, and consequently none of the experiments showed whether the cement would retain its good properties after the main was used for conducting gas for some time. Until it is definitely known what effect, if any, gas will have on neat cement, particularly in the presence of moisture, the information needed for a satisfactory decision of the questions involved is incomplete.

It must be acknowledged, however, that the information now available indicates that pipe lines under moderate pressures and laid on good foundations offer a field for cement joints deserving more attention. They have been employed more or less for many years in Great Britain. They are used in the United States exclusively on the mains of ten gas companies and almost exclusively on the mains of nineteen companies, out of fifty-two to which inquiries were sent by Mr. von Maur. Some of these companies have been using cement joints for more than twenty-five years, and many of them report that less leakage occurs with cement joints than those made with lead. There are occasional troubles where the cement joint is not properly made, just as is the case with any other type of construction, but it is self-evident that a cement joint is made more easily than one of lead, and accordingly it ought to be practicable to secure a better grade of workmanship with less difficulty than with lead for a filling.

There are certain other advantages of the cement joint which deserve consideration. One of these is its high electric resistance, which is important in reducing damage by electrolysis. The reason return currents from street railways stray to water and gas mains is because they are good conductors of electricity. The less their conductivity is made, the smaller will be the current flowing through them. Another fact of importance is the strength of the joint, as shown by the St. Louis tests. There is considerable difference of opinion as to the necessity of providing for expansion in gas pipes, although it is difficult to understand why any such provision must be made. When the pipes are buried below the frost line, as is usually the case, the maximum difference between their summer and winter temperatures is amply provided for by the elasticity of the metal and joints, even when the latter are of cement. Any material which will resist hard usage in the way that the cement joints at St. Louis acted is able to withstand all the temperature stresses coming upon it in a pipe line with three or four feet of earth cover, and a pavement over that. As for the use of cement joints in lines on bad foundations, that is a matter which has another side wholly apart from the material used in the joints. It will probably prove advisable in such cases to make a good foundation for the line, and not trust to the joints to hold the pipe together; that is not what joints are for, and it is hardly good practice to require such service of them.

Notes and Comments.

THE FAST RUNS on the Pennsylvania and New York Central lines between New York and Chicago are now definitely assured; in fact, it is apparent that both roads could make considerably better time were there any real need to do so. As the schedule is now arranged, it is possible to do considerable business in one city on one day and reach the other in time for business the next day, which is all that conditions require. The Pennsylvania route, 912 miles, is somewhat the shorter, but its grades and curves east of Pittsburg are heavier than those on the New York Central route, which is approximately 960 miles.

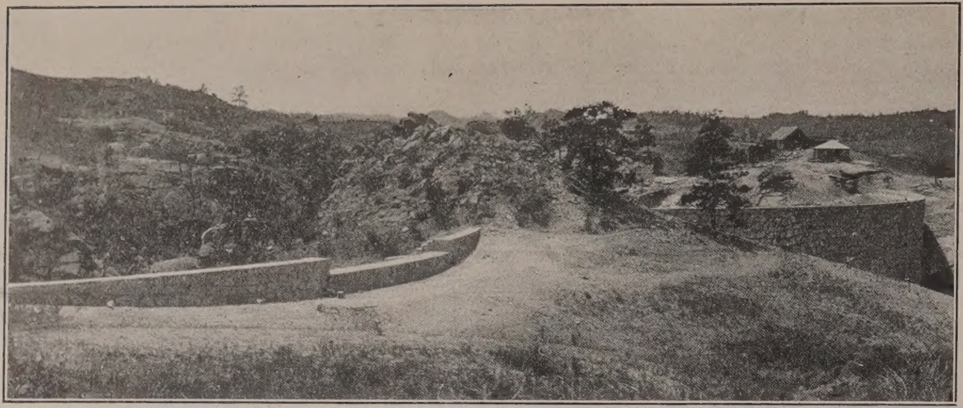
SOFTENING OF CAST-IRON BY SEA WATER has been occasionally observed by engineers who have examined submerged pipe lines. Mr. W. H. Thorpe states in "Engineering" that he found somewhat diverse conditions on 45 cast-iron piles in various structures. In no case was there any general softening of the whole thickness, but merely a distinct change for some definite thickness inward. It was most marked close to the ground and generally disappeared at a height of 5 ft. Different piles in the same structure did not show the same amount of softening. The injured material taken from a pile 36 years old was soft, greasy and black, but after expose to the air for a few hours becomes a dry yellow powder.

THE PSEUDO-CONCRETE FOUNDATION for pavements, which has come into use in the Central States, is now being tried in Worcester, Mass., the city which has the worst streets in the country, in proportion to its population, according to a report by Mr. John W. Alvord. The foundation as made in Worcester consists of 5 in. of crushed field stone or granite laid on the subgrade and rolled down with a steam roller. This broken stone is covered with Portland cement grout on which granite blocks are laid in the usual way. The claim made for it is low cost, in comparison with real concrete. It is, of course, much more pervious to water and therefor more liable to settlement than a substantial concrete foundation, and the thin coating of grout is probably not of enough value to warrant using it. Nevertheless, this construction is enjoying a certain measure of favor just now, and on this account its wearing properties must be carefully observed.

THE COST OF LAYING PAVEMENTS of the same character in different cities varies so greatly that it is dangerous to base estimates for one place on work done in another without a careful comparison of the cost of each item in the two localities. The wages for labor, cost of materials and hauling must be considered, as well as the different thicknesses and qualities of the two pavements. This is, of course, well known to contractors and engineers, yet the non-technical critic frequently overlooks it. For example, the bitulithic pavement was recently assailed by a Cincinnati paper because its cost for a proposed piece of roadway was considerably greater than the price charged for bitulithic pavements in other Ohio cities. This street required heavy grading, unusual thickness of the pavement owing to bad soil, expensive crushed stone, costly hauling and labor charges much above those in other cities in the State. These facts naturally would not appeal to an uninformed critic, who looked upon a yard of pavement as an unvarying unit everywhere.

THE NATURAL BED of building stone is one of its most important properties and most specifications for good masonry require the blocks to be set on their natural beds. Nevertheless a large amount of masonry is laid every year in which this requirement is wholly ignored. The most conspicuous recent example of the failure to bed the stone properly is Holy Trinity Church in Brooklyn, which is now having its exterior made over. This edifice is a Gothic structure of much architectural merit, considered artistically, but is marked by a grave blunder of construction. It is built of a red sandstone of open texture, not well suited for this climate, and laid with the natural bed vertical. As a result the walls and spire offered comparatively little resistance to the weather and disintegrated seriously, particularly on the south side of the spire, where the alternation of freezing and thawing in the cold season occurs most frequently. It is estimated that the repairing of this blunder will cost over $100,000, a sum which indicates the importance of the little clause in masonry specifications to which reference has been made.

THE SHOVEL is the subject of some interesting comments by an Italian writer on earth-work. He states that the handle of American shovels is too short and that the longer handles used in Europe are far better. He argues that the handle forms a lever, the left hand of the shoveler is the fulcrum, and the right hand applies the working force at the end of the handle; the longer the handle, or the leverage, the greater the amount of power produced at the beade of the shovel by the same force at the other end. As a matter of fact this theory has been exploded by trial a good many times. Years ago, American shovel handles were longer than they are now, but they have been gradually shortened because it was found that this could be done to advantage. Any man who uses his arms for the main labor of shoveling does not know how to work. It is the proper swing of the whole body that makes a good shoveler beat completely the usual crew of incompetents who putter around with pick and shovel in the large cities. A really competent man uses his shovel with very little pump-handle motion of his right hand, but throws the strength of his whole back into the work. In certain kinds of trench excavation, long-handled shovels are desirable to offset the drawbacks of the narrow working space, but elsewhere the present length of shovel handle is about right if the men are taught how to work properly.



View of Spillway with Top of Dam in the Distance.

MASONRY DAM FOR THE GRANITE SPRINGS RESERVOIR, CHEYENNE, WYO.

By A. J. Wiley, M. Am. Soc. C. E., Chief Engineer.

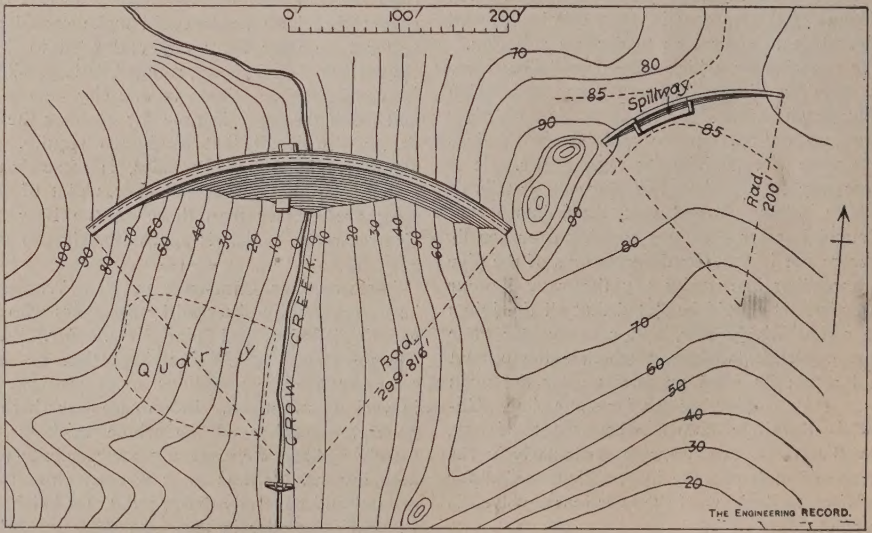
The city of Cheyenne, Wyo., obtains its water supply from Crow Creek, a tributary of the South Platte River, through a combined gravity and pumping system owned by the city.

At a point about six miles from the city a submerged dam intercepts the underflow of the creek, and above the dam a system of filtration galleries beneath the bed of the creek carries the water to a central well. From this well the water is conveyed in a vitrified clay pipe to a covered masonry distributing reservoir at a sufficient elevation to distribute the water through the city by gravity. A series of lakes is formed on the high ground to the north of the city by filling a number of natural basins from an open canal, heading in Crow Creek below the filtration galleries, and catching the surplus water of the stream. These lakes are filled at the high-water stage of the creek, and used to supplement the low-water period by discharging back into the creek, near the city, upon a second set of filtration galleries, whence the filtered water is conveyed to another masonry reservoir in the lowest part of the city. From this reservoir the water is pumped into the city mains at times of scarcity and in case of fire, in order to increase the pressure secured by gravity from the upper reservoir. The city has a population of about 15,000, and the water is used for lawn sprinkling as well as for domestic purposes. At the season of extreme low water the consumption is about 2,000,000 gal. per 24 hours, of which 1,200,000 gal. comes from the upper filtration galleries and 800,000 gal. through the lower galleries from the lakes.

The watershed of Crow Creek above the city is approximately 250 square miles, but from a large portion of this area the run-off is very slight, and during the summer season the entire flow of the stream is derived from the comparatively small area of mountainous country in which the creek has its source. The principal run-off takes place in April, May and June, when the accumulated snow of the higher drainage area is being melted by the beginning of summer.

Many small irrigation ditches, mostly for the use of individual ranches, take water from Crow Creek, and in the year 1888 the water was adjudicated under the State irrigation law, and the rights of the 52 claimants defined in the order of their priority of use, the city of Cheyenne securing the first right to the use of 12.48 second feet. This would give the city an ample supply, but, unfortunately, it is far more than there is flowing in the stream at the season of lowest flow and greatest use, when the flow at the upper filtration galleries goes as low as 1,200,000 gal. per day, or less than 2 cu. ft. per second. The obvious remedy for this shortage is the storage of flood water, and this had been done on a small scale by the use of the natural lake beds as described above. These, however, were limited in extent, and the loss by evaporation from the shallow reservoirs was very heavy.

About 12 miles above Cheyenne, Crow Creek divides into three branches, the North Fork, the South Fork, and the Middle Fork. The South Fork has a very small watershed and a small run-off. The North Fork and the Middle Fork have about the same area of watershed, but the North Fork drains a comparatively low and flat country with no facilities for storage. The Middle Fork heads in the Continental Divide north of the Sherman Summit on the Union Pacific Ry., and drains a country composed almost entirely of bare granitic rocks, or slopes of disintegrated granite, with an altitude ranging from 7,000 to 10,000 ft.



Plan of Granite Springs Dam and Spillway Site, Cheyenne Water Works.

An examination of the storage facilities of the Middle Fork was made for the city by the U. S. Geological Survey, and it was found that, at what is now known as the Granite Springs Reservoir, a dam 90 ft. high would have a capacity of 5,321 acre feet, or about 1,734,000,000 gal., with a water surface covering 185 acres. The capacity of the reservoir for different heights is given in the accompanying table.

Capacity of Reservoir.

Gage, height.	Area, acres.	Capacity, acre-feet.	Capacity, gallons.
90	185.15	5321.35	1,733,972,000
85	164.79	4446.50	1,448,894,000
80	147.13	3666.70	1,194,802,000
75	128.70	2977.15	970,109,000
70	113.37	2371.95	772,905,000
65	99.01	1841.00	599,893,000

Rainfall and Run-off.—The average annual precipitation is 13.23 in. The maximum for any one year was 20.79 in. in 1896, and the minimum of 5.04 in. occurred in 1876. The greatest average monthly precipitation is 2.37 in. for May, and the least is 0.37 in. for November and December, with 0.38 for January and 0.53 for February. April, June, July and August range from 1.47 to 1.96 in. per month. The greatest precipitation for any one month was 6.66 in. for May, 1904, and the months of September, October and November occasionally pass entirely without precipitation.

As practically all the precipitation for the months of December, January, February and March occurs as snow, which all melts in the months of April, May, June and July, it follows that nearly all the run-off is concentrated in these four months.

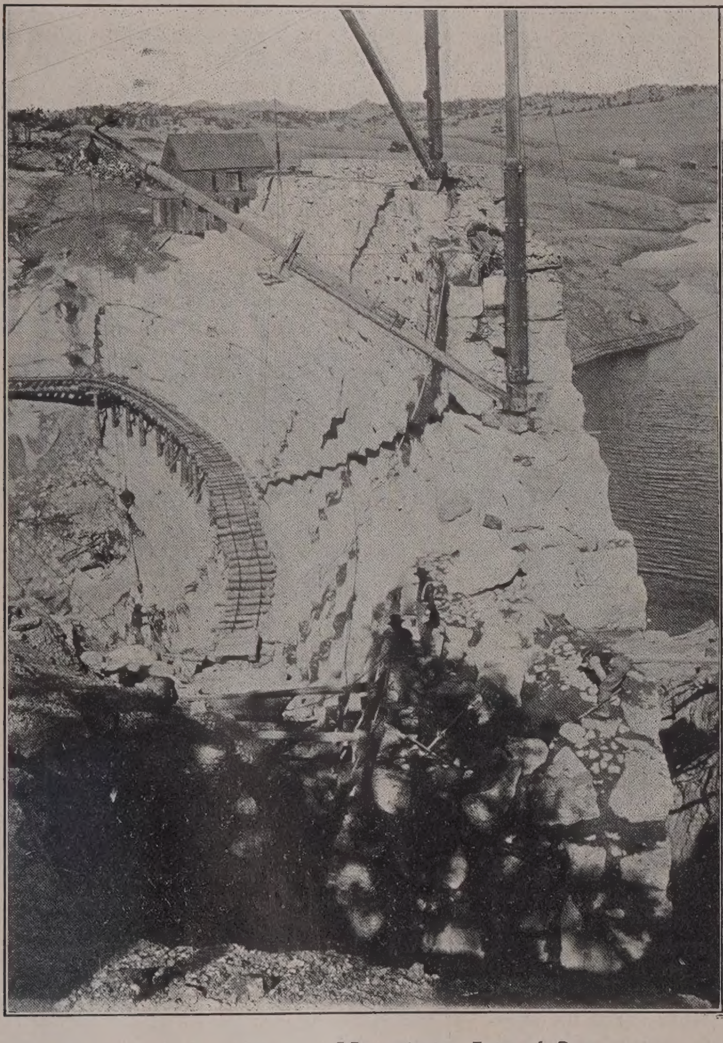
The observations of the U. S. Geological Survey in 1903 show a total run-off of 7,344 acre feet from 27.5 square miles of watershed, with a rainfall of 12.25 in. This run-off is 41 per cent. of the precipitation, and 65 per cent. of it occurred in April and May, which only contributed 21 per cent. of the precipitation. April, May and June gave 79 per cent. of the run-off and 32 per cent. of the precipitation.

Organization.—The decision to supplement the water supply of Cheyenne by storage on the Middle Fork of Crow Creek at the site described above was made in 1902, and immediate steps were taken to put the decision into practical shape. At the inception of the work, Mr. John L. Murray, one of the leading business men of the city, was Mayor, and Mr. M. P. Keefe, a contractor of wide experience, was Chairman of the Water Committee. During the latter and greater part of the construction Mr. Keefe was the Mayor and Mr. S. A. Bristol and Mr. R. W. Warren were successively the Chairmen of the Water Committee. From all of these and from Mr. W. D. Pease, City Engineer, the engineers entrusted with the execution of the work received the most cordial co-operation.

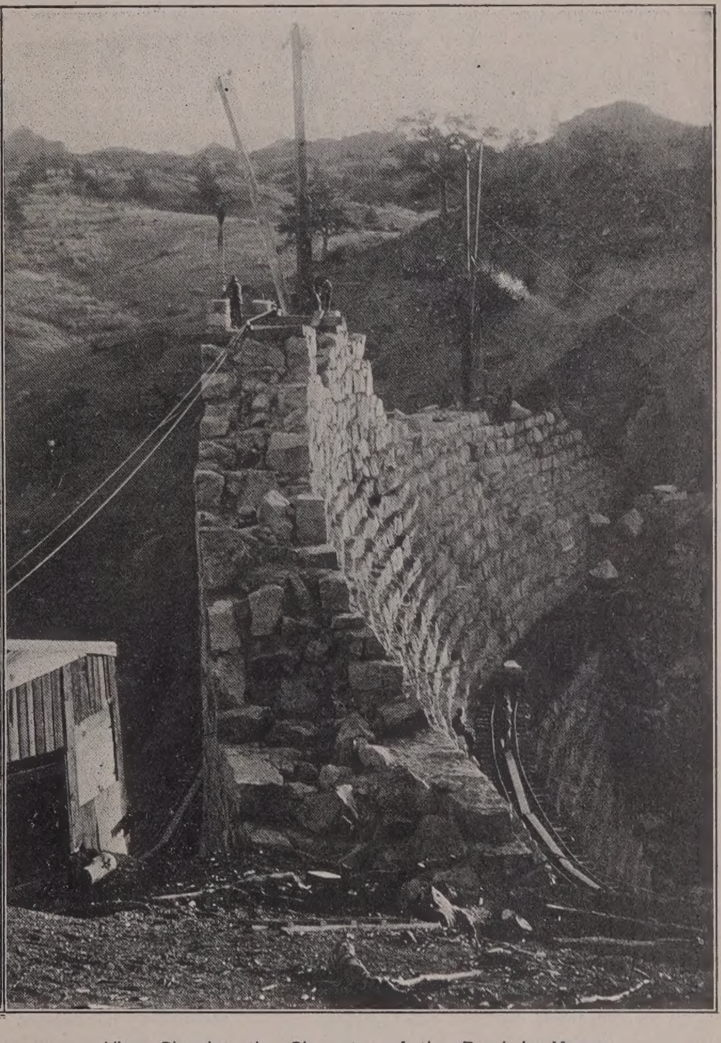
In May, 1902, the writer was employed as Chief Engineer with instructions to design a dam for the lowest possible cost consistent with absolute safety. Plans and specifications were prepared for a masonry dam of gravity section, and a contract for its construction was made with Gaffy & Keefe, of Denver, Col., on Aug. 21, 1902. Mr. G. W. Zorn was appointed resident engineer and occupied this position throughout the construction of the dam.

Progress of the Work.—On account of delays in the shipment of machinery, no masonry was laid in 1902, but the contractors' plant was installed, and the water of the creek was diverted through the outlet pipe. The first masonry was laid on April 20, 1903, and when work was stopped for the season, because of cold weather, on Nov. 20, 11,420 cu. yds. of masonry had been laid, out of a total of 14,422 yds. Work was resumed on April 11, 1904, and the last masonry was placed in the dam on June 21. The construction of the spillways and measuring weirs occupied nearly another month, and the work was completed on Aug. 15, 1904.

General Description.—The dam is constructed throughout of uncoursed rubble masonry laid in Portland cement mortar. It is curved in plan but of gravity section, the arch form being selected as giving additional stability without requiring more masonry than would have been necessary for a dam straight in plan. The location was indicated within very narrow limits by the topography of the canyon, the most favorable site, both on account of the excellent foundation and of the possibility of constructing a spillway entirely separate from the dam, being at the upper end of the canyon at the lower end of the reservoir basin. At this place the creek flowed on bare granitic rock, and from the creek bed the slopes on either side rise at the rate of two and a quarter horizontal to one vertical. On the right side the hard rock was exposed for nearly the entire height of the dam, but on the left side the entire slope was covered with disintegrated granite. About 200 ft. east of the left end of the dam, and separated from it by two peaks rising to a height of 30 ft. above its crest, is a natural depression, or saddle, about 85 ft. above the creek bed. In this saddle the spillway was located with its crest 90 ft. above the creek bed.



Track from Quarry on Downstream Face of Dam.



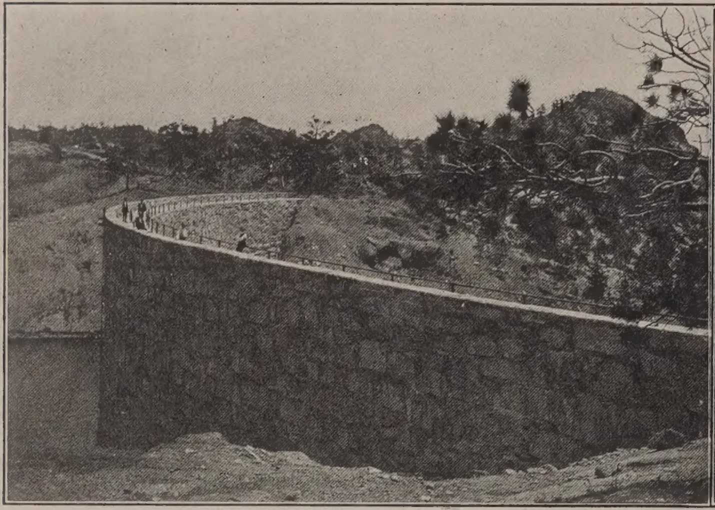
View Showing the Character of the Bond in Masonry.

Dimensions.—The dam is constructed on a curve of 300 ft. radius. Its extreme height from foundation to parapet is 96 ft. Its length on the base is 10 ft., and on the top is 410 ft. The thickness on top is 10 ft., and on the base, 56 ft. The parapet wall is 2 ft. thick and 3 ft. high. The dam contains 14,422 cu. yd. of masonry. In calculating the section of the dam, it was assumed that the specific gravity of the granite rubble masonry would be 2.5, corresponding to a weight of 156.25 lb. per cubic foot. The specific gravity of the rock was found to be 2.83, corresponding to 177 lb. per cubic foot, and the average specific gravity of the mortar was calculated to be 2.21, corresponding to a weight of 138 lb. per cubic foot. The estimated weight of the masonry is 165 lb. per cubic foot, corresponding to a specific gravity of 2.64. The dam was so designed that the lines of pressure corresponded with the limits of the middle third with a specific gravity of 2.5, but the line of pressure reservoir full, with a specific gravity of 2.64, falls one foot inside the middle third at the base.

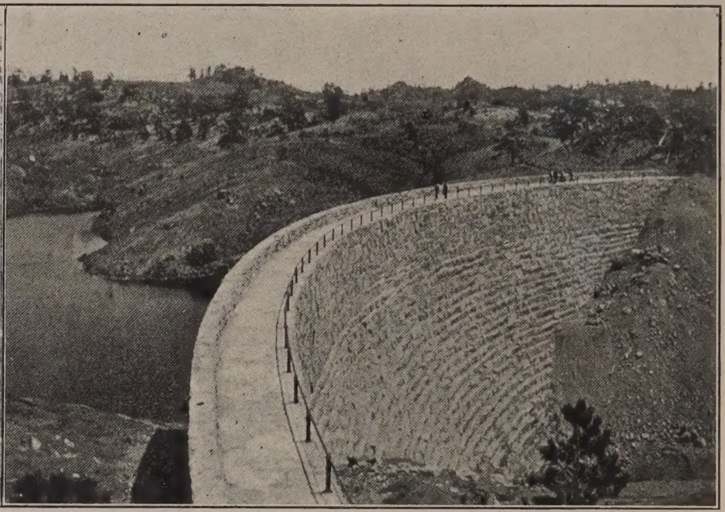
Foundation.—The entire base of the dam, except that part of the east end which lies more than 50 ft. above the creek bed, is a variety of granite known as gabbro, a dense, hard rock, entirely free from seams or cracks and almost devoid of cleavage planes. Above El. 50 at the north end the gabbro ceases to rise and is overlaid by a different variety of granite with regular cleavage planes. This granite is soft on the surface, but increases in hardness with depth. At the plane of contact with the underlying gabbro there is no apparent seam, though there is a marked difference in the hardness and texture of the rock. The soft part of this overlying rock was excavated, and in places a depth of nearly 30 ft. was attained before a satisfactory foundation was found. A great part of the gabbro rock had been worn to a smooth vitreous surface which was roughened by shallow shooting, or by rough pointing, previous to laying masonry.

Outlet.—Water is drawn from the reservoir through a 24-in. cast iron pipe laid on the bed rock 12 ft. above the creek bed. The pipe is 1¼ in. thick, with bolted flange connections, and has a 24-in. high-pressure Rensselaer standard water works valve at each end. The upstream valve is protected by a timber screen, and is operated by a hand-wheel with an indicating stand mounted on the crest of the dam, and connecting with the valve by a vertical non-rising stem supported at intervals of 14 ft. by brass boxes set in stones projecting from the face of the dam. The stem is divided to feet by brass graduations, and serves as a gauge rod for the reservoir. The upstream valve is usually kept wide open, the regulation being done by the downstream valve, which is more accessible. This valve is also operated by a hand-wheel on an indicating stand, which is set immediately over the valve.

Construction Methods and Appliances.—The dam is constructed throughout of uncoursed rubble masonry laid in Portland cement mortar. The rock used was taken from the ledge on which the dam is built, the quarry being located on the right bank of the creek about 100 ft. below the dam. The rock was practically devoid of stratification or cleavage and had to be blown in large masses from an open face 20 to 40 ft. high. Powder was used as sparingly as possible to avoid shattering the rock. For each yard of rock quarried there was used 0.35 lb. of dynamite and 1.05 lb. of black powder. The stone used ranged in size from spalls to 4 cu. yd., probably averaging about 2 cu. yd. The largest rock used contained 5 cu. yd., and weighed nearly 12 tons, but rocks of over 3 cu. yd. required such great care in handling that they were not so profitable as smaller rock. Rocks breaking smaller than 3 cu. yd. were used as they were blasted out of the quarry, and larger masses were split up by plug and feather into roughly rectangular shapes. The best-shaped stones were used for face stones, the ordinary rough rocks were used in the body of the dam, and the smaller pieces made the spalls. All drilling was done by hand. The rock was taken from the quarry by a guyed derrick with 40-ft. boom, and loaded upon platform cars. The track was laid upon such a grade that the loaded cars ran alone and the empties were pushed back by hand. The trestle which carried the track was supported by the steps on the downstream side of the dam. Upon the top of the dam were located two guyed derricks with 40-ft. booms similar to the quarry derrick. Each of the three derricks was operated by a 10-ton hoisting engine located in an engine house near the south end of the dam. The derricks on top of the dam took the rock from the cars on the lower side of the dam and set them in the masonry. They also took the mortar buckets from the cars on the upstream side of the dam and dumped them where needed on top of the dam.



General View of Upstream Face of Completed Dam.



General View of Downstream Face of Completed Dam.

Spalls were brought upon the dam in skips, holding about a cubic yard each, and kept in the skips until used. The mortar was usually dumped in half-yard batches in a convenient depression of the masonry, and was distributed with long-handled, round-pointed shovels.

The upstream face was laid with the joints in the true plane of the face. No objection was made to having the convexity of a stone project beyond this plane, but no stones with concave faces were permitted in the face of the dam. The upper 20 ft. of the downstream face was laid in the same manner, but the rest of the downstream face was laid in rough steps, with half the step inside and half outside the theoretical plane of this face. The stones in both these faces were laid to break joint and were well bonded into the body of the dam. In the body of the dam but little attention was paid to the bond of the work, the irregular stones insuring this without effort, but every precaution was taken to insure the filling of voids. To this end the mortar was used very wet, even sloppy, and the chief rule observed was that there should first be placed a large excess of mortar of which the largest possible percentage was to be displaced by rock.

In setting the large rock, a bed was prepared with spalls and mortar, and then a considerable excess of mortar was placed on the bed. The rock was then slowly lowered and settled on the bed by working it with bars. The excess mortar would ooze from under the rock, which would then float upon an even layer of mortar, filling all the spaces under it. During this operation, the inspector, either standing upon the rock or having his hand upon it, can tell if the rock is riding or rocking, and, if necessary, has the rock raised and the bed readjusted. The large rocks were set as close as possible to each other without being in contact, the intervening spaces being filled with mortar and spalls. In this work, the masons were not permitted to sandwich the spalls between layers of mortar, but were required to first fill the space with wet mortar in which the spalls were submerged, displacing as much as possible of the mortar. While it was the intention to have the masonry brought up in horizontal benches extending the full length of the dam, the exigencies of the work prevented this, and the middle portion of the dam was completed first, stepping off toward each end.

Proportions of Rock and Mortar.—The total contents of the dam are 14,422 cu. yd., of which 35.2 per cent., or 5,008 cu. yd., are mortar, and 64.8 per cent., or 9,414 cu. yd., are rock. The total amount of cement used was 8,843.75 barrels, which gives 0.613 of a barrel to the cubic yard of masonry.

Rate of Laying Masonry.—The average rate of progress was 60 cu. yd. of masonry per day of 10 hours. The best monthly rate was 2,370 cu. yd. during July, 1903, averaging 83 yd. for a 10-hour day, or 41.5 yd. of masonry per 10-hour day for a single derrick, including the time lost in moving and resetting derricks. During this month, the average daily force employed was as follows: In the quarry, 21.3 men, 1⅓ engine runners, and one derrick; in screening and hauling masonry, 3.5 masons, 6.5 helpers, 2⅔ engine in mixing and delivering mortar, 3 men; in laying masonry, 3.5 masons, 6.5 helpers, 2⅔ engine runners, and 2 derricks.

Mortar.—The face stones and those laid in contact with the bed-rock were laid in 3 to 1 mortar, and all the interior of the dam in 4 to 1 mortar.

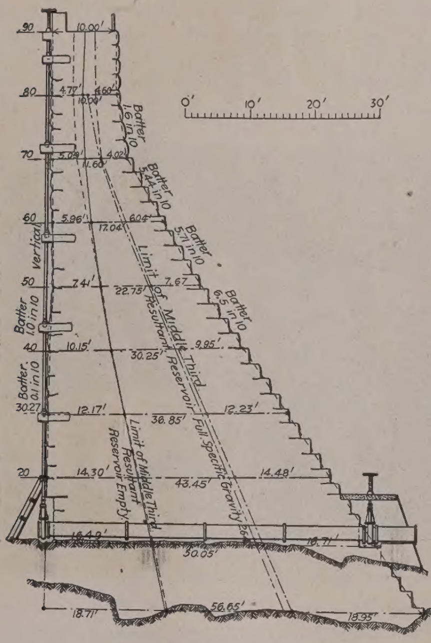
The mortar was mixed in a Smith mixer having a capacity of 6 yd. per hour, and driven by a direct connected 6-h. p. engine, and proved a most reliable and efficient mixer. The sand and cement were placed in hoppers discharging directly into the mixer, and the latter was discharged by the operator into a steel bucket holding 17 cu. ft. The mortar was mixed in batches of half a cubic yard each, first dry and then with approximately 20 per cent. water.

The mixing plant was located on the upstream side near the west end of the dam. The mortar track was carried by a trestle built against the upstream face and extending entirely across the canyon at an elevation of 40 ft. above the creek bed, or 50 ft. below the crest. Two men were required to supply sand and cement to the mixer, and one man attended to the mixing and delivered the mortar at a point on the mortar track where it would be reached by one of the derricks on the dam.

Sand.—The sand was obtained from shallow deposits in dry stream beds, and hauled in wagons an average distance of half a mile to the dam site. It was passed through slotted screens with ⅜-in. openings and used without washing. The voids in the sand were determined by depositing it slowly in a measured depth of water in a cylindrical vessel. After compacting the sand by light blows upon the sides of the vessel, the depth of the sand was measured and the depth of the water above the sand. The difference between this latter and the original depth of the water was taken to represent the voids, and divided by the depth of sand to determine the percentage of voids. The sand used in making tests was taken from the stock at the mixer and was always slightly damp.

The result of 25 tests taken at intervals throughout the work gave an average of 23.4 per per cent. voids, with a minimum of 17 per cent. and a maximum of 25 per cent. Twenty-eight per cent. of the sand passed a No. 20 sieve, and this portion contained 33 per cent. voids.

Cement and Mortar Tests.—Alpha cement was used exclusively on the work. It was shipped in canvas sacks and a test sample was taken from every twentieth sack, or fifth barrel, as it was unloaded from the car. A standard pat on glass plate was made from each sample; then all the samples from a car-load were mixed and tested for fineness, and for tensile strength, neat, and mixed with three volumes of sand. All the standard pats were allowed to set 24 hours under a damp cloth, then half were put in cold water which was brought to the boiling point and kept there for 6 hours. The remaining half were kept in cold water for 28 days. In the tests for soundness, pats occasionally blistered or scaled slightly and sometimes came loose from the plate, but never showed the slightest evidence of distortion. The setting tests were made on the pats used for determining soundness, and showed that the average time of initial set was 45 minutes, varying from 30 minutes to one hour, while the final set always took place within 10 hours. The average of fineness was 93 per cent. through the 100-mesh sieve. In the tensile tests, 12 standard briquettes of neat cement, and 12 of one volume of cement to 3 sand, were made from the mixed samples from each car.



Cross-Section of Dam.

The aim in making these tests was to get results fairly comparable to those obtained in the construction, and the cement and mortar were mixed as wet as they could be handled. Daily tests were also made of the mortar used in the masonry by taking samples directly from the batches delivered on the dam. These tests were all made by the same man, the rodman on the work, and without effort to get specially high results. The briquettes were allowed to set 24 hours in damp air, then placed in water, and sets of three were broken in 7 days, 28 days and 90 days. The results of these tests show that for neat cement the average tensile strength per square inch for 7 days, 28 days, and 90 days, respectively, were 654, 792 and 806 lb. For 1 to 3 hand mixed mortar the results were respectively 235, 312, and 345 lb., and for 1 to 4 machine mixed the results were 226, 306, and 361 lb. In obtaining these results a total of 1,344 briquettes were broken; 324 each for neat cement and 1 to 3 mortar, and 696 for the 1 to 4 mortar.

The Spillway.—The spillway is located in a depression or saddle 200 ft. northeast of the dam, and the discharge from the spillway enters the creek 500 ft. below the dam. The saddle is 180 ft. long and is closed by a wall whose crest is at the same elevation as the parapet of the dam. The spillway section is 52 ft. long and 3 ft. lower than the parapet. Its discharge capacity is approximately 900 cu. ft. per second, or twelve times the observed maximum discharge of the stream, and equal to a run-off of 33 cu. ft. per second per square mile of watershed. The spillway is built upon a curve 200 ft. radius. The foundation of the face wall was made by cutting a trench 4 ft. wide in the soft granite of the foundation to a depth of from 3 to 6 ft., where a fairly firm rock was encountered. This trench was filled with wet concrete with a large percentage of one and two-man rock imbedded. Above the surface rubble masonry was used. In the spillway section the masonry was 4 ft. wide on top, with a batter of 9 in. to one foot on the downstream side to the elevation of the natural surface, where it terminates in an apron formed by excavating 12 in. of the soft granite and replacing it with an equal depth of concrete. The apron is strengthened by two parallel ribs of concrete, each 2 ft. square, in trenches cut beneath the apron, one at its upstream end and the other at its downstream end.

ESTIMATED COST OF GRANITE SPRINGS RESERVOIR.

Mortar.		
Sand, labor of men and teams	$5,496.58	
Blacksmithing	651.00	
General expense	930.00	
5,008 cu. yd. sand at $1.41		$7,077.58
Mixing and delivery, labor	$1,488.50	
Power	220.00	
Int. and depreciation on plant	620.00	
General expense	270.00	
5,008 cu. yds. mixing and delivering at 0.52		2,598.50
5,008 cu. yd. mortar at $1.93 +		$9,676,08
Quarrying and Delivering Rock.		
Common labor		$9,987.50
Engine runners		1,314.00
Fuel (estimated)		730.00
Blacksmithing		1,225.00
Steel		389.40
Explosives		1,428.06
Int. and depreciation on plant		1,644.00
General expense		1,734.64
9,414 cu. yds. rock at $1.96		$18,452.60
Laying Masonry.		
Labor, masons and helpers		$7,180.11
Engine runners		2,628.79
Fuel (estimated)		1,460.00
Blacksmithing		341.00
Int. and depreciation on plant		3,100.00
General expense		1,308.00
Laying 14,422 cu. yds. masonry at $1.11		$16,017.90
Cost of Masonry in Dam.		
9,414 cu. yds. of rock delivered, at $1,96		$18,452.60
5,008 cu. yds. of mortar delivered, at $1.93		9,676.08
14,422 cu. yds. of masonry laying, at $1.11		16,017.90
14,422 cu. yds. not including cement, at $3.06		$44,146.58
8,844 bbls. of cement, at $3.58		31,665.38
14,422 cu. yds. of masonry, including cement at $5.25 +		$75,811.96
Cost per cu. yd. in terms of masonry.		
0.652 cu. yds. rock, at $1.96		$1.28
0.348 cu. yds. mortar, at $1.93		0.67
1.00 cu. yds. laying, at $1.11		1.11
1 cu. yd. of masonry, not including cement		3.06
0.613 bbls. cement, at $3.58		2.19
Total cost per yard, including cement		$5.25
Clearing Reservoir Site.		
Common labor		$640.72
Blacksmithing		82.72
General expense		116.00
Total		$839.44
Excavating 1447 cu. yds. from base of dam.		
Common labor		$1,147.86
Blacksmithing		110.00
General expense		208.00
Total		$1,465.86
Cost of labor on Spillway.		
Common labor		$374.00
Blacksmithing		81.00
Masons		94.00
Teams		202.00
General expense		200.00
Total		$951.00
Cost of Labor on Measuring Weirs.		
Common labor		92.00
Masons		70.00
Teams		40.00
General expense		25.00
Total		$227.00

The Measuring Weirs.—Two weirs are provided, one near the upper end of the reservoir and the other 300 ft. below the dam. The weirs are identical in construction and dimensions. They are built of rubble masonry on bed rock, with angle iron crests. The weirs are of the trapezoidal or Cippoletti type and are 6 ft. long on the crest. They are provided with sluicing valves and permanent gauges.

Clearing of Site.—The whole area of the water surface is 185 acres, and the contract required that all vegetable matter should be cut down within 6 in. of the ground. The greater part of the area required no clearing, but bordering the creek and most of its branches was a dense growth of heavy brush and small trees, while on some of the area there were scattering pine trees.

Estimated Costs.—The accompanying estimate is submitted as an approximation of the actual cost of the work to the contractor. In this estimate it is assumed that the depreciation upon the plant in the two seasons' use was 50 per cent. of its original cost. A large part of the fuel consumed by the plant was obtained in clearing the reservoir, but in making up the estimate this was not taken into consideration, and the cost of the power was estimated upon the basis of the consumption of 5 lb. of coal per horse-power hour of actual working time for the nominal horse-power of the engines, with coal at $6 per ton delivered.

Cost of the Work to the City.—The accompanying statement shows the entire cost of the work to the city, including right-of-way, engineering, and administration, and the material used in construction:

ENTIRE COST OF WORK TO THE CITY.

Right of way and water rights	$3,480.36	
Clearing of reservoir site	994.00	
Cost of reservoir site		$4,474.36
Buildings	$958.96	
Excavating 1,447 cu. yds. foundation, at 80c.	1,157.60	
Excav. and preparing foundations	2,670.52	
Outlet pipe and valves furnished and laid	1,650.69	
8,844 bbls. cement, at $3.58	31,665.38	
14,422.16 cu. yds. masonry, at $3.85	55,525.32	
Railing on dam crest, 386 lin. ft. at 80 cts.	308.40	
Engineering, superintendence and general expense	7,794.33	
Total cost of dam		101,731.20
190.47 cu. yds. of concrete in spillway, at $4.50	$857.11	
129.62 cu. yds. rubble in spillway, at $7.00	907.34	
196.7 bbls. cement in spillway, at $3.58	704.16	
Total cost of spillway		2,468.61
49.76 cu. yds. rubble in weirs, at $7.00	$348.32	
37.8 bbls. cement, at $3.58	135.29	
Valves and crests	36.72	
Total cost of two weirs		520.33
Total cost of reservoir		$109,194.50

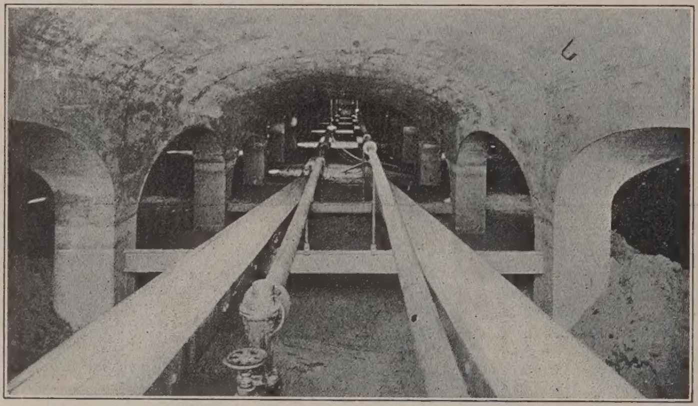
Temperature Effects.—During the past winter when the temperature was below the zero point, a barely perceptible crack appeared about 100 ft. from the west end of the dam, where it is about 30 ft. high. This crack extended entirely around the section in a generally vertical plane, following the joints of the masonry except in one place where it want half way through a rock. There are no other indications of temperature effects, and with the warmer weather the crack has entirely closed.

Seepage.—With each rise in the reservoir there is some sweating of the downstream face, which stops when the water level ceases to rise for about 30 days. The amount of this seepage is about equal to the evaporation from the downstream face on a hot day, when it practically disappears.

The Management of the Roxborough Water Filters, Philadelphia.

The Lower Roxborough filters of the Bureau of Water Purification of Philadelphia are five in number, each of 0.53 acre extent. At the Upper Roxborough station there are eight filters of 0.7 acre each. All are covered, as explained in detail in previous articles in this journal. Their joint capacity is 32,000,000 gal. daily. So much interest is manifested in these works that the following explanation of their management is reprinted from a report by Mr. John W. Hill, chief of the Bureau:

Both stations are managed by an assistant engineer, with headquarters at Upper Roxborough. Each is provided with three filter attendants standing eight-hour watches, with a labor roll of eleven men who are worked as required by the sand scrapings, restoring sand, etc., mutually at both stations. Lower Roxborough is provided with a night watchman and Upper Roxborough with a day watchman. The Upper and Lower Roxborough offices are connected by special telephone with the pump room at the Roxborough auxiliary station to control the operation of the centrifugal pumps which supply water from the Upper Roxborough reservoir to the filters and the electric lighting machinery. The three engineers in charge of the low service pumping machinery and electric lighting equipment constitute a part of the working force of the Roxborough system.



Ejector Pipes for Handling Sand, Upper Roxborough.

Sand Ejector in Operation, Lower Roxborough.

At Upper Roxborough an engineer is employed to run the sand washer and ejector pumps and a mechanic is employed to make pipe repairs and adjustment of working appliances, who works as occasion requires at each station. The total force of employes regularly on the work is 25, including the assistant engineer in charge. An additional force of laborers is required when sand is being restored to the filters.

Lower Roxborough.—The total quantity of water filtered at Lower Roxborough for the year ending Dec. 1, 1903, was 2,257,000,000, equivalent to a daily yield of 6,183,600 gal. During this period the filters were supplied with subsided water from the Upper Roxborough reservoir. During the first 2½ months of the year the scraped sand was wheeled from the filters to the washers, but since March all sand has been transported to the washers by means of a Korting ejector, operated in a portable hopper and connected up from place to place in the filter, with the water pressure and sand discharge pipe lines.

During the year the aggregate number of scrapings of filters was 51, an average of 10 to each filter, giving an average period of operation of 35.8 days.

Each filter is equipped with electric lights, which permits the scraping and transportation of sand in the coldest weather without opening the ventilators in the roof or keeping the entrance door long open. This operation has already been successfully conducted with the temperature as low as 11° Fahr., the sand going through the discharge pipes of the ejectors, through the washers and being stored in the courts without interruption or hindrance by reason of the low temperature.

The total amount of sand scraped and washed at Lower Roxborough for the year was 4,514.7 cu. yd., with an expenditure of 14,416,000 gal. of water to transport and wash, which, with water at $25 per million gallons for pumpage and filtration charges, represent a cost of $360.40, or about eight cents per cubic yard of sand washed.

The average expenditure of water per cubic yard of sand transported and washed was about 3,200 gal.

The total cost of operating the Lower Roxborough filters during the year was $9,168.48, equivalent to a cost of $4.06 per million gallons filtered. Considering the fact that this station with the same labor charges, excepting cost of replacing sand, can supply easily 12,000,000 gal. per day, it will be seen that when the pumpage to the Lower Roxborough reservoir will admit of steadily maintaining a rate of 10,000,000 to 12,000,000 gal. per day that the cost of filtration per million gallons will be materially reduced. It is probable that with this station working at an average rate of not less than 10,000,000 gal. per day the cost of filtration will not exceed $3 per million gallons.

Upper Roxborough.—The first six filters at Upper Roxborough were started in service July 3, 1903, another filter was started July 25, and the last filter was started Aug. 8. The total quantity of water filtered since starting to Dec. 1 is 1,601,920,000 gal., at a total cost of $5,523.47, or at the rate of $3.45 per million gallons. The average daily rate of work was 10,608,000 gal.; this is about one-half the easy capacity of the filters, and with an increased daily rate of work the per million gallon cost of filtration will be very materially reduced.

The total scrapings of sand at this station were 17, aggregating 1,740.2 cu. yd, and an average thickness of scraping of 1.0625 in.

By the combined washing of the scraped sand in the ejector and one hopper only of the sand washer the turbidity of the sand is reduced quite 99 per cent.

The ejector and washer apparatus at this station is of later design and more efficient than that at Lower Roxborough, and the work of cleaning a filter can be performed more expeditiously. Scrapings amounting to 125 cu. yd. have been removed in 10 hours with a working force of eight men. At this station no sand has ever been removed from the filters by wheelbarrows. The sand washers and ejectors are supplied with filtered water at 80 to 90 lb. pressure per sq. in.

The easy capacity of the Upper Roxborough filters is 20,000,000 gal. per day, provided the Upper Roxborough reservoir can be kept full and the water drawn off to the filters with from six to seven days subsidence. The cost of running this station will be but slightly greater if the yield is 20,000,000 gal. than it is at 11,000,000 gal. per day. The force of men necessarily employed is equal to the work required by the larger volume of water, with the possible exception of three helpers to the engineers at the low service pumping station, the increased consumption of fuel for pumping to the sand washers and ejectors, and the increased consumption of electric current used in the work of scraping filters after daylight hours; there will also be a small increase in the cost of oil, waste and small stores. This increased cost for nearly double the capacity of the station will be materially overcome by the reduced cost per million gallons of water filtered.

Cost of Cleaning Filters.—In the accompanying table the material data with reference to the scraping and washing of sand from the Upper Roxborough filters will be found. Since these filters have always been operated with the ejector, representing the least cost for handling sand, they are offered as showing the probable depth of sand to be scraped; the cubic yards scraped per million gallons of water filtered; the cost of handling sand per cubic yard, not including refilling the filters, and finally, the cost of cleaning filters per million gallons of water filtered. The respective columns are explained by their headings. The fourth column contains the yield in million gallons for the run of the filter, and the fifth column the yield per acre for the run of the filter.

DATA REGARDING SAND SCRAPING AND WASHING, UPPER ROXBOROUGH FILTERS.

Filter.	Run.	Days run.	Yield of run mil. gals.	Yield per acre mil. gals.	Depth of scraping.	Cubic yards scraped.	Cost per cu. yd. to scrape and wash.
No. 1.....	1	74.62	85.52	122.17	1.24	116.5	$.60
	2	28.85	51.92	74.17	0.90	84.8	0.85
No. 2.....	1	59.79	66.82	95.46	0.95	90.0	0.82
	2	40.58	76.56	108.00	0.73	69.0	0.87
No. 3.....	1	90.06	119.60	170.86	1.43	134.6	0.49
	2	43.56	65.68	93.83	0.80	76.2	1.12
No. 4.....	1	45.28	89.58	127.97	1.60	150.4	0.74
	2	48.85	60.36	86.23	1.18	110.8	0.91
No. 5.....	1	66.12	95.51	136.44	1.94	173.0	0.68
	2	38.63	69.02	98.60	0.97	91.6	0.77
No. 6.....	1	60.88	79.54	113.63	0.72	67.9	0.98
	2	62.67	75.80	108.29	1.02	96.1	0.96
No. 7.....	1	51.00	107.60	153.71	0.60	56.6	0.63
	2	47.71	79.60	113.71	0.94	88.2	0.68
No. 8.....	1	56.12	92.71	132.44	0.84	90.5	0.54
	2	56.75	87.82	125.46	1.25	117.6	0.63
Totals........		871.47	1303.64	1860.97	17.19	1613.8	$12.27
Average.......		54.47	81.48	116.31	1.074	100.86	0.767

Average cost for scraping, transporting and washing sand per million gallons of water filtered....... $.95

Method of Operation.—When the filter tank has been supplied with the collector pipes at the bottom, the gravel underdrains, and the sand filled in to the proper depths, all is in readiness for putting it in operation. The first step is to fill the filter from below with filtered water, if it be available, until the level of the water stands 4 or 5 in. above the surface of the sand. It is left in this condition for a period of one week or ten days until the sand has thoroughly set and assumed its natural elevation in the tank.

In starting the first of any series of filters, of course filtered water is not available, and the first filter must necessarily be filled with subsided water at Upper Roxborough, or with water coming direct from the Schuylkill River, as at Lower Roxborough when the first filter at this station was started last August.

After the filter has been backfilled, working from below upwards to the surface of the sand bed, to the depth mentioned, raw water is then cautiously drawn into the filter until the elevation of the water above the sand is about 3 ft. The filter is then allowed to rest for from six to twelve hours until a "schmutzdecke," or mud membrane, is formed at the surface of the sand. The effluent valve connecting the filter with the clear water basin is then opened and the filter started at a slow rate. For the first two or three days of service the filter is run at from one-third to one-half the normal rate. At the end of three or four days the water is such that the filter can be rapidly raised to the full normal rate at which it will be used for the period of service.

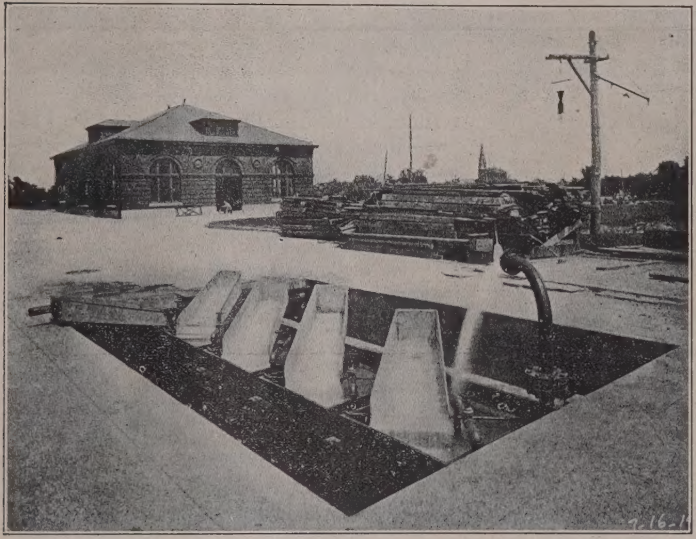
Between the time of starting the filter and stopping it the period of operation will represent from twenty to eighty days, the shorter period, of course, occurring with the more turbid condition of the applied water and the longer period with the condition of the water that usually subsists during the later spring, summer and early fall months. The average period of operation as determined by the 1903 experience of the Lower Roxborough filters is 32 days.

At the end of the period of service of the filter the inflow is entirely stopped and the water above the sand level allowed to slowly percolate through the sand bed until the level has subsided to a depth of about one foot below the surface of the sand bed, when the outflow is stopped, the filter opened and the upper dirty layer of sand, containing the mud and other suspended matter, carefully scraped off. The depth of this scraping is regulated by the depth of the layer of discolored sand and will vary from ½ to 1 in. when the applied water is bad or the period of operation of the filter longer than usual.

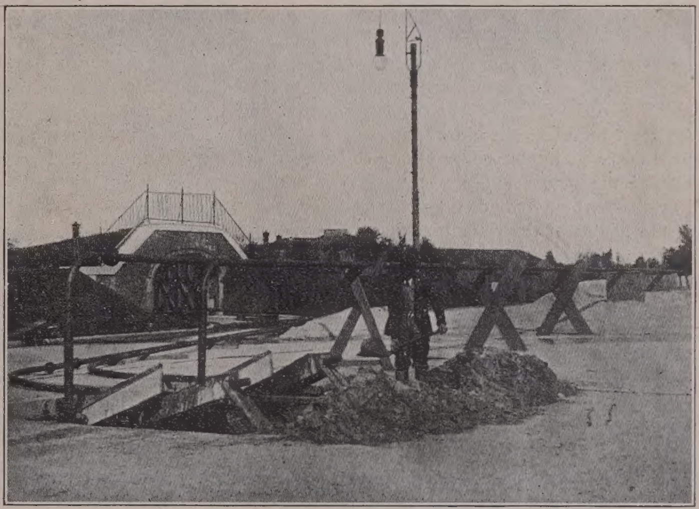
In operating a series of filters it is customary to fix the total amount of water to be filtered from day to day, varied, of course, by the season of the year, being greatest in summer and least in winter, and by the influence of Sundays and other holidays, when the consumption of water for manufacturing purposes is largely reduced or wholly intermitted.

With reference to the number of filters actually in service from day to day, of the five filters at Lower Roxborough and eight filters at Upper Roxborough only one filter in each case is taken out of service for the purpose of scraping the sand bed, and the rates of operation on the remaining filters are correspondingly increased to maintain the normal daily yield of water from the filters.

The period that each filter is out of service for the purpose of scraping the sand, transporting the sand to the sand washer and washing and storing the sand in the courts is usually two days, although when the scrapings are unusually heavy an additional day for the purpose of scraping may be required. Ordinarily, however, a filter will be out of service between the time when it is stopped for scraping and the time when it is again backfilled to be started in operation, as described, not more than two days.



Sand Washer, Upper Roxborough Filters.



Sand Washer in Operation, Upper Roxborough.

After a series of filters has been started in service the backfilling before mentioned is always done with filtered water, and it is only when the first filter of a series is started that unfiltered water is used for this purpose. By this it will be seen that after the operation of the first filter of the series the only water that ever permeates the underdrains and the sand bed is filtered water, either refilled from below or percolating in the operation of the filter through the sand bed from above.

When a filter is temporarily taken out of service the first step is to scrape the upper layer of dirty sand into little piles or hillocks. The area scraped into each hillock is about 15 ft. square; i. e., in each bay of the filter one little hillock of dirty sand is heaped up. After the scraping has been accomplished a portable ejector, weighing about 150 lb. and easily transported by two men, is carried into the filter, the inlet of which is connected with a water supply pipe and the outlet connected with a discharge pipe, conveying the mixed sand and water from the ejector to the sand washer in the court in front of the filters. After the stream of water has been started through the portable sand ejector the little heaps or hillocks of sand are shoveled into the hopper of the ejector and the mixed sand and water carried through the discharge pipe and delivered into the first hopper of the sand washer, automatically passed through the sand washer and from the last hopper of the washer discharged into convenient piles on the court in front of the filters. The only manual work connected with the transportation and washing of the sand is represented by the shoveling of the little hillocks of sand into the ejector. The remainder of the work is accomplished entirely by a stream of water acting under a pressure varying from 60 to 90 lb. per square inch.

Steam Turbines in America.

An important review of the present condition of the steam turbine in this country was prepared for the recent convention of the National Electric Light Association by a standing committee comprising Messrs. W. C. L. Eglin, A. C. Dunham, I. E. Moultrop, George W. Cato and J. D. Andrew. The committee reports that there are now 224 American-built turbines of over 350,000 h.p. capacity in operation, of which four are 5,500-kw. machines, ten are 5,000-kw., four are 3,000 kw., thirteen are 2,000 kw., and nineteen are 1,500-kw. These are distributed so widely that anybody interested in such turbines can inspect an installation without having to travel very far. Information concerning the operation of 59 of these installations was furnished by the owners, and although the committee made a special effort to obtain a complete state of troubles due to the use of turbines, very little data of this nature was available.

One company, operating Curtis turbines, reported one shutdown caused by a worn bearing on the tachometer drive vibrating the rod operating the latch on the emergency stop valve. This resulted in the emergency valve closing suddenly without any warning. The same company also reported slight trouble with the generator, due to loose laminations in the armature. The latter trouble was discovered and remedied before any damage was done. On another Curtis turbine, the users experienced some little difficulty with the needle valves and the main nozzle valves, due to warping caused by the high degree of superheat used in the plant. On another turbine of this type some trouble was experienced from air leakage in the turbine and also from water mixing with the oil lubricating the step-bearing. This company also states that it had some trouble with the condensing apparatus, but omits to state just what the trouble was.

On a De Laval turbine, one company reports some trouble due to design of the brush-holders on the dynamo, which was easily remedied. On another De Laval turbine, trouble was reported with the oiling. This seemed to be due to the filling up of the spiral oilways which stopped the flow of oil, and was overcome by the use of special oil carefully filtered.

One company using Parsons turbines reported some difficulty in the matter of lubrication. The oil, which worked well in one part of the machine, solidified into a jelly and failed to work in some of the other bearings. On another Parsons turbine, trouble was reported due to the repeated cutting out of the throttle valve seat, which tended to cause the turbine to race on light loads. This difficulty was attributed to the peculiar water used in the locality. They also report trouble from excessive vibration of the turbine, caused by the expansion of the exhaust pipe throwing the turbine out of line. This developed some months after the turbine was started and was entirely corrected by installing an expansion joint in the exhaust pipe.

Two Parsons turbines are reported to have encountered trouble with the field coils of the generator, both machines burning out under less than normal load. This is apparently due to an error in the design. They have had some difficulty with the breaking of the brass sleeves of the concentric bearing. They also report that they find it necessary to give the lubricating system special attention to avoid trouble with it.

One report has been received on a Parsons turbine stating that a large number of the blades were lost because the turbine was started too quickly. Superheated steam was being turned on and sufficient time was not allowed in warming up the machine to maintain proper clearance between the tips of the blades and the casing. On another Parsons turbine trouble is reported from many of the blades of the rotor breaking while running and without rubbing. Another company, operating several Parsons machines, reports it has had a few blades broken out of one of its turbines due to some foreign substance being carried into the turbine through the steam pipe. This did not affect the operation of the turbine, which was continued in service until it was convenient to shut it down and repair it.

Curtis Turbine.—In visits to the General Electric Works the committee discussed with the engineers of the company the use of the mechanically operated valve in place of the electrically operated valve, which is at present the standard practice. One mechanical type, operated by power transmitted from the turbine shaft by means of a worm wheel and gearing, was designed by Mr. Richard H. Rice, and follows closely the best lines developed from engine experience. The other mechanical type is operated hydraulically, a water piston giving reciprocating motion to a rod controlling a bank of valves that are opened by means of a cam and closed by a spring. The governor controls a pilot valve which in turn operates the hydraulic piston, the motion of which is transmitted to the cams that open the valves. In the first case the valves are thrown open or closed, and in the second there is a throttling action of the valves. The one objection to be raised to the mechanical form of valve, the committee states, is that it necessitates the use of a small number of valves of large area, and some criticism has been raised that the regulation of the turbine will not be so good with that type of valve as with the larger bank of valves of smaller diameter that are electrically operated.

The committee reports that a decided improvement has been made in the electrically controlled valves by placing the springs and stems outside of the casing, and in certain details in the construction of relays and pilot valves. The latest type of electrically operated valves appears to be working satisfactorily. The throttle valve and emergency stop formerly used on the Curtis turbine were not considered satisfactory. Improvements have been made and the gate valve has been superseded by a double-seat, balanced globe valve with emergency stop attachment.

The brake applied to some of the earlier types of turbines has been abandoned, and is not considered part of the standard machine. It has been found in practice, however, that the brake was useful in holding up the weight of the revolving parts when repairs or examinations were being made on the machine, and the company was asked to take under consideration the advisability of adopting on all of the larger sized machines an attachment similar to the brake for this purpose, and they will furnish in the larger sizes such an attachment as part of the standard machine when so specified.

There are various opinions held as to the maximum clearance allowable in this type of turbine without interfering with the efficiency, but the view now held by the General Electric Co. is that the amount of clearance imposed by the mechanical conditions does not in any way affect the efficiency of the turbine. This is especially true of the four-stage type of machine.

The most important advances made in details during the year, the committee states, were changes in the construction of the wheels so as to form a smooth surface by the removing of all bolt heads and ribs, bolts being substituted by countersunk rivets, thus reducing the friction of the revolving parts. Important changes have also been made in the shapes of the buckets and in the construction of the nozzles. These changes have all been made with the object of improving the economy of the machine. Step bearings are now being operated with water instead of oil, and the construction has been modified to admit of this change. The committee has been unable to find a single case where the step bearing has given any serious trouble.

Westinghouse-Parsons Turbine.—The committee reports that the type known as the two-stage has been dropped. This was really not a two-stage turbine, but the wheels of larger diameter were placed in a separate casing, by which, at that time, it was thought some advantage could be gained in economy by reheating the steam between these two stages. It was found in the experiments this could not be accomplished, and as it was more expensive, it was dropped. Now all the sizes are practically on the same line, merely increasing in size to provide capacity, with the exception of certain sizes operating at lower speeds, in which the diameter of the wheels is very much increased. Particular attention is now being given to the blades, and some of the machines now being built have steel blades, and some blades of various alloys.

The most important improvement in the construction of the blading, the committee states, is the addition of a flat lace of steel which is threaded through openings near the outer edge of the blades and fastened by twisting the flat steel lace between each blade. This performs two functions: first, it maintains a uniform spacing between the outer edges of the blades; and, second, it increases the mechanical strength of the blades and prevents vibration. In the larger sizes the longest blades are made from drop forgings with special ends which are machined so as to fit in a dovetailed groove and fastened at the outer end by means of the band lacing previously described. The joint in the lacing is made by introducing a second lace nearer the shaft, the blades at the joint having two holes punched, and a short piece of wire is arranged at the break of the outer lacing strip to lap the joint. Tests have been made to see whether this band strip in any way affects the efficiency. Thus far, however, these bands have not shown any change. It is expected that this lacing will overcome most of the trouble that has been experienced in the failure of blades.

Some minor changes have been made in the oiling system. The old system of oiling was to pump the oil through cooling coils to a tank arranged above the turbine to obtain a static head of two or three feet of pressure on oil bearings. This has been changed to a closed tank, and a pressure is maintained in the tank of about seven pounds by means of a by-pass valve controlled by the pressure on the tank. This change was made on account of insuring constant and liberal flow of oil on all bearings without largely increasing the size of the storage tank.

The company is experimenting with a double-flow turbine in which the steam is admitted at the centre and expands through the turbine to the outer ends, being connected at the exhaust opening to the condenser. This has a number of mechanical advantages. First, it obviates the necessity of connecting pipes through balancing pistons and various pressure points, it shortens the length of the shaft, and more than doubles the capacity of the turbine of the same length. The machine is merely in an experimental stage, and sufficient tests have not been made to learn whether the economy is as good as that of other types. It possesses a number of features, however, that appear to the committee to be worthy of mention and form an index of the possible future developments of this type of turbine.

Other Turbines.—The Hamilton-Holzwarth machine of the Hooven-Owens-Rentschler Co., the machine of the Allis-Chalmers Co., the De Laval turbine and the Zoelly turbine of the Providence Engineering Works are not discussed at length by the committee, owing to lack of information concerning the operation in service.

High Vacuum.—The committee lays much stress on the importance of a high vacuum, pointing out that while a reciprocating engine's use of vacuum is limited by the capacity and efficiency of the low-pressure cylinder, the turbine is prepared to make full use of steam down to the lowest point of vacuum obtainable. Quite a number of experimenters have made tests to determine the economical effect of an increased vacuum, and it is interesting to note that these results approximate fairly close to each other. The committee reports a number of tests, including some of its own, and reaches the following conclusions as to the value of high vacuums. It assumes a 2,000-kw. unit working at an average load of 1,500 kw. for 15 hrs. per day, coal at $3, evaporation 9 lb., steam consumption 22 lb. per kilowatt. A rise of vacuum from 26 to 28 in. may be assumed to increase the economy about 6 per cent., the committee estimates. The water thus saved will be 140,000 cu. ft., worth at $2.58, a total of $35, and the coal saved will be worth $1,500. This makes a total saving of $1,535. The condenser plant for a 28-in. vacuum will cost $5,000 more than one for 26 in.; interest, depreciation and other fixed charges on this sum will be 17 per cent., or $850. This does not include the extra cost in steam to run the larger auxiliries, but inasmuch as such exhaust steam would return a benefit to the feed water if they were all steam-driven, the committee assumes that the extra cost in water is 2 per cent. of the total required by the turbine, and is worth $12 a year. Hence the total net saving is $673, which, at 5 per cent., represents a capital saving of $13,460 due to the higher vacuum.

Leakage of Air.—An important feature of operation with high vacuum is the necessity of having air-tight stuffing boxes and pipe joints, lack of which results in loss of economy to the turbine and increased consumption of steam by the dry-vacuum pumps and circulating pumps. The committee suggests the following as some of the remedies:

All joints after being made up can profitably be gone over with any heavy homogeneous paint (this preferably should be done when working under vacuum), such as black asphaltum, or shellac and red lead, both of which dry readily. This is a simple remedy and when carefully applied is very effective. There often is considerable air brought into the feed water at pumps and open tanks; and it is desirable to work the water of condensation on a closed system, or, when an open system is used, to arrange that the water is as little stirred up as possible; liberation of entrained air might be assisted by the use of steam coils in the bottoms of tanks.

In pressure pipes when velocity of the water is slow it is possible to trap off considerable air by the use of a stand-pipe communicating with the feed pipe by a narrow slot and having at the top a float-actuated snifting valve.

Unless close supervision is used to see that lazy or indifferent engineers do not cover up the existence of air leaks by pushing their air and circulating pumps at a greater speed and power than would be necessary with tight joints in exhaust piping, condensers and stuffing boxes, the operating costs can be very appreciably added to in a manner that often defies detection. Connections from turbine to condenser and condenser to pumps should be as short as possible to avoid the chance for leaks and consequent uneconomical operation.

Condensers.—Where a surface condenser is of the counter-current type an independent air cooler appears to be an unnecessary expense and care if the condenser cooling surface is of the proper amount. In the parallel-flow type, however, an air cooler is undoubtedly of considerable benefit in reducing the tension on the air and non-condensable vapors.

Many types of condensers are laid out with a solid bank of tubes presented to incoming steam. Naturally the steam has to seek its way between the tubes to get to the body of condenser, and in narrow condensers the net area between tubes of each layer may be even less than the area of exhaust pipes, and consequent velocity of the steam through these passages may mount into tens of thousands of feet per minute. The desire in a condenser should be that the incoming steam would immediately spear out over the whole cooling surface in its proportionate amount, otherwise only a limited area of surface will be devoted to the act of condensing and the remainder to cooling down condensed water. Very good results have been obtained toward increasing the efficiency of condensers by opening channels between tubes equal in aggregate area to the exhaust pipe and extending somewhat beyond the centre of the tube nests. The benefits were manifested in an increased vacuum with the same amount of cooling water and a radical decrease in the tendency of the vacuum to drop under ovrloads. These channels also offer a greater entrance area into the body fo the tubes, by way of the interstices between the tubes forming the sides of the channels.

The committee recommends that on all new contracts purchasers insist upon adequate means of inspecting the ends of tubes and for obtaining admittance to the condenser above and below the tubes. All openings should be made to accommodate the enty of a man wherever possible. This detail is naturally one of operation in which operating engineers are especially concerned, as it has to do with labor costs for repairs. It has the further economic value that any piece of apparatus that is easy to inspect is going to be maintained in a more efficient condition than one on which overhauling is a difficult matter.

Undoubtedly the best arrangement of the condensing plant, the committee says, is the use of a counter-current condenser placed as close to the exhaust nozzle as possible and with the dry-air pumps drawing from the condenser at the point of coolest circulating water; this pump is also so placed that the minimum of pipe connection can be used. With this arrangement the possibility of air leaks would be greatly reduced, the quantity of circulating water would also be lessened owing to the lower tension of the air which has just left the coldest tubes of the condenser.

Carbonization of Oil.—Considerable trouble has been reported from carbonization of the oil in the air cylinders of the dry-air pumps. This has led in some instances to the use of a high grade of mineral oil especially produced for use in air compressors. There have also been reports that this has not cured the trouble. While the temperature in the cylinder does not rise to an excessive amount, yet if a temperature could be maintained below a possible critical point this trouble might be eliminated. The simplest way to do this would seem to be to jacket with cold water the valve casing and covering over which the hottest air, that of compression, is continually sweeping. The metal surrounding the ports in the cylinders is perhaps the greatest accumulator of heat, and if these port passages were cast with walls no thicker than necessary, further supplemented by cooling water, the trouble would be minimized. An inter-cooler between cylinders of a two-stage pump would also be of very considerable benefit both as to decreasing carbonization and as to increasing the efficiency of the air pump; the remedy used by one correspondent, where he boiled out the air cylinder once in two weeks' time with caustic soda, was very aptly called by himself, "a nuisance."

Relief Valves.—Atmospheric relief valves are undoubtedly to blame for some of the air leakage into the condensers. Where the vacuum is of so great importance, as in turbine work, it will undoubtedly pay to go to further refinements in the design of these valves in the endeavor to secure automatically absolute tightness. It is common practice to use a water seal on these valves, but there is seldom provision made to insure that it is always maintained. It may either be no seal at all or the exhaust pipe full of water. It should be possible, now that the use of oil has been done away with by the turbine, to replace the present brass seats on valve body and disc with hard rubber. Rubber would be flexible enough to take up any inequalities in the seats due to machining or to distortion from heat and the strains of the large exhaust piping. The usual present design of relief valve does not allow of ready inspection, thereby offering but another excuse for the engineer to "let her go" until he cannot escape criticism from even the most obtuse layman.

The Accident in the Gunnison Tunnel.

By I. W. McConnell, Construction Engineer, U. S. Reclamation Service.

The Gunnison tunnel, now under construction by the United States Reclamation Service, will be used as a diversion channel to carry the water of the Gunnison River into the Uncompahgre Valley. The tunnel when completed will be over 30,000 ft. in length, with a carrying capacity of 1,300 cu. ft. per second. The water way will be 10 ft. in width at the bottom, with an approximate height of 14 ft. to the crown of the arch.

This work was advertised for contract, and was let in the winter of 1904-05 to the Taylor-Moore Construction Co., of Hillsboro, Tex. Work was begun early in January by the contracting firm, and was carried on in a more or less satisfactory manner until May 27, 1905. The contractors became involved in financial difficulties, and on May 28, the government officials took possession of the work. As it was very important to keep the work going, the contractor's organization was not changed, and the same men and foremen continued the work night and day in three shifts of eight hours each.

The cavein occurred on the morning of May 30 (see Eng. Record, June 17). The contractors had run in a small heading at grade for about 700 ft. from the portal, and had been ordered at the beginning of May to enlarge the heading to full size and to put in the permanent timbering so that the tunnel should be perfectly safe. When the accident occurred all of this work had been done except two stretches, one of 21 and one of 57 ft. The cavein occurred at the 21-ft. stretch. The ground encountered at this end of the tunnel is of a very treacherous nature, being composed of layers of varying thickness of adobe, sand and gravel, with occasional seams of mud and water. Where the cave occurred the nature of the ground was such as to lead the timbermen to believe that they were safe in supporting this 21-ft. stretch with temporary timbering until the permanent timbers could be placed. In this supposition it now appears that they were mistaken, for an examination of the ground in the cave shows that there was a bed of gravel and sand immediately above the hard clay, and the entire 21 ft. caved without warning whatever, filling the tunnel with the débris. Naturally there were many vacant spaces left in the mangled mass of timbers, and in these spaces four of the men caught in the cave were imprisoned. While this 21-ft. stretch was being timbered there were 19 men employed in pushing ahead the face of the tunnel; that portion of the tunnel in which they were working being about 180 ft. long between the 57-ft. stretch and the face. When the cave occurred, of course these men were cut off from exit from the tunnel, but they were released in about 24 hours, by sinking a shaft from the surface. Of the four men who were caught in the timbers alive, two were rescued by this gang before they were released from the tunnel. Two others remained unhurt in the timbers for 50 hours, when they were rescued. The other six men caught in the cave were instantly killed.

Most of the men employed in the tunnel are hard ground miners, and are not as well versed in handling soft ground as railroad tunnel men. Of course there has been a different foreman in charge of each shift, and an error of judgment on the part of any one of these men as to the nature of the ground may cause a fatal accident. The methods employed by the contractors for driving the tunnel were not approved by the engineers, and they were ordered to change them, but during the process of changing the accident occurred.

The cave was cleared away and the last of the dead bodies recovered during the afternoon of June 8. Although the ground in places is very heavy, the permanent timbers have not shown the least sign of settlement. If they do, however, concreting will be commenced, and continued until the heavy ground is passed.

A MARSH ROAD, 2.23 miles long, was built last year from Ocean City, N. J., to the mainland. The foundation was poor in most places, and was accordingly protected on each side of the road by driving a double row of piles and connecting them with planks, forming a rough coffer dam about 4 ft. wide, within which material was filled in and consolidated. As a further precaution a bank of turf was placed inside the inner planks. The roadway proper has 4 in. of gravel, which seems to be enough for the light travel over it.

The Platform Shelters of the New Lackawanna Terminal at Hoboken.

A departure from the usual type of train shed has been adopted for the new terminal passenger station of the Delaware, Lackawanna & Western Railroad at Hoboken, N. J. The proposed shed consists of a number of low, short-span, longitudinal sections, built up of structural steel, reinforced-concrete and wire-glass, with the steel protected from the locomotive gases by concrete and with copper in all places where exposed metal is required. The general plan of the station and the terminal improvements were described in The Engineering Record, April 29, 1905. The uncertain conditions of the site would occasion considerable difficulty in securing proper foundations for a train shed of the ordinary kind and the erection of such a structure would seriously interfere with the heavy traffic under which the construction must be carried on. The difficulty of maintaining a shed with single long truss spans of steel subjected to the gaseous exhaust from locomotives was also considered to be a strong factor in favor of the adoption of the proposed shed.

The original plans embodying 16 tracks under the shed have been changed so there will be 14 tracks, in pairs, with concrete platforms, 20 feet wide, between each pair. A longitudinal section of the shed covers each pair of tracks and half of the platform on both sides of them. The details of one of the sections are so clearly shown in the accompanying illustration that a slight explanation of the general arrangement is alone necessary. The roofs of the sections have been designed to comfortably clear the largest locomotives now in use on the Lackawanna Railroad. The adjacent sections are supported by longitudinal rows of columns, placed 27 feet on centers down the middle of the platforms, with a transverse built-up roof girder at each transverse column row. Resting on the transverse roof girders will be longitudinal purlins which will directly support the reinforced concrete roof slab and the skylights in it. That part of the transverse girders directly over the locomotive smokestack and the longitudinal purlins on both sides of a longitudinal opening in the roof over the locomotive stacks will be entirely incased in concrete.

The longitudinal opening over the locomotive stacks extends the entire length of the train shed, and with the exception of the crossing of the roof girders, is entirely open so the locomotives may exhaust directly to the outside. A built-up section incased in a concrete slab, 4 inches thick and 2 feet 1 inch high, is placed on edge on either side of the opening, as shown in the illustration, to direct the gases in their passage from the stacks, to protect the longitudinal purlins, and to avoid rain and snow being blown in on the platforms. The top of the stacks will be so close to the openings it is believed that practically all of the exhaust from them will be discharged directly to the outside. Most of the noise from an engine blowing off steam and a greater part of the steam will also doubtless be carried outside in the same manner.

Three continuous skylights, 6 feet wide, of wire-glass will be placed longitudinally in the roof of each section. One of these will be at the peak of the roof and will admit light directly to the inside windows of the cars on the tracks below. The remaining two rows of skylights will be placed over the platforms, one on each side of the tracks so as to admit light to the outside windows of the cars. The proximity of the skylights to the car windows, it is believed, will avoid to a great extent the poor light usual in most train sheds.

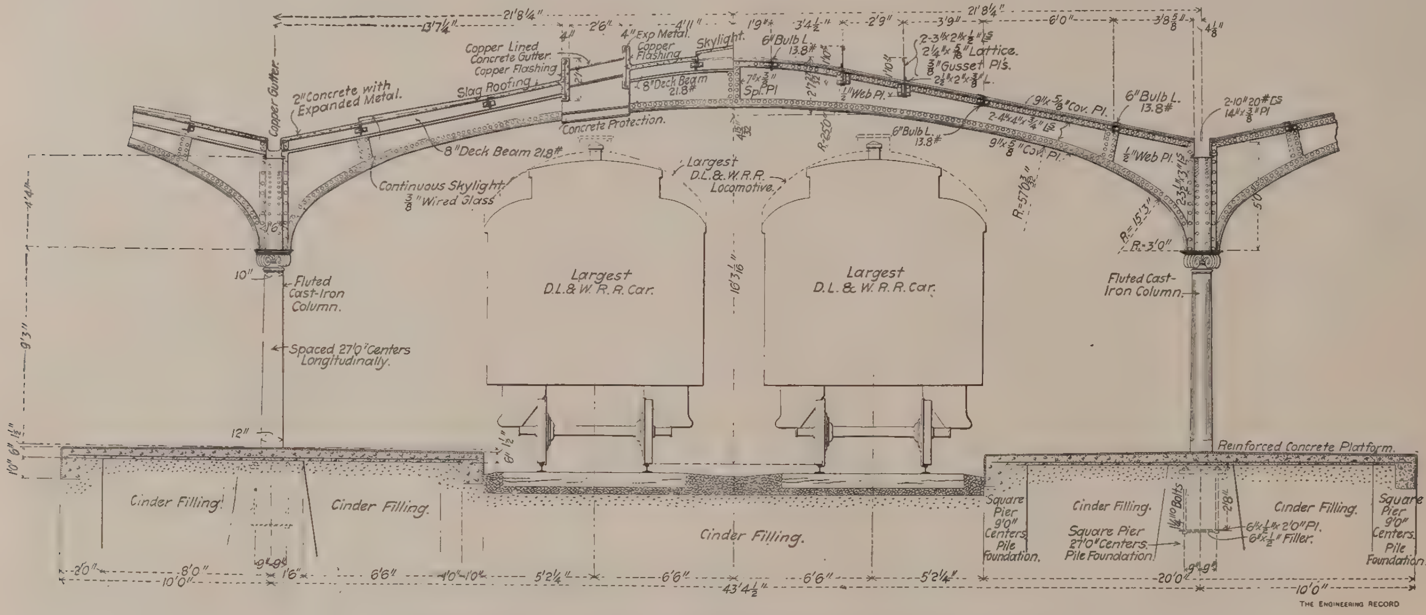
The roof of each section is pitched slightly toward the line of the transverse column rows in addition to its heavy transverse pitch in both directions from the center. A copper gutter is placed over each longitudinal row of columns and connected to a down spout in each of the vertical columns, which are hollow cast-iron. If any difficulty is experienced with ice and snow in the gutters of columns during the winter, steam pipes will be placed in them and connected with the main from the power plant of the terminal.

A continuous, although uniform settlement has been taking place back of the bulkhead line at the terminal for a number of years, and the footings of the concrete platforms and the platforms themselves have been designed to avoid any difficulty from this source. Three rows of piles will be driven under each platform, one under each outer edge and one down the middle. Small square piers will be built on 9-ft. centers on these rows of piles, and similar piers on pile footings will be provided for the columns supporting the train shed roof. The platforms will be reinforced with expanded metal and supported directly on the rows of small piers and the column piers.

The platforms have been made sufficiently wide to avoid any crowding that may be occasioned by the single row of columns down the middle of each of them. The baggage and express will be handled from the station to the cars along a separate platform at one side of the shed, which connects with a platform crossing the tracks beyond the trains. It is entirely feasible to construct a subway beneath the tracks where the platform that crosses them is to be placed and connect it with baggage elevators in the platforms between the tracks; but this will not be constructed until its necessity is shown.

The longitudinal sections of the shed can be erected in accordance with the general plan of constructing the terminal station in sections without materially interfering with traffic. The transverse roof girders will be delivered to the site ready to be put in position and the columns, main beams and all of the roof framing can be erected rapidly and readily with a derrick car. The chief advantage of the adopted design, however, in addition to its adaptability to the site and the conditions of construction to be met, is considered to lie in its greatly reduced cost of construction and maintenance as compared with the cost of constructing and maintaining a high single long-span shed with a roof supported on steel trusses.

The general design of the train shed was developed by Mr. L. Bush, chief engineer of the Delaware, Lackawanna & Western Railroad, and the details have been worked out under his direction.



A Half Transverse Cross Section Between Girders and a Half Transverse Cross Section Through a Girder of a Section of the Train Shed.

The Pollution of Water was recently before the Iowa Supreme Court in Bowman v. Humphrey, 100 N. W. Rep., 854. This was a case where a stream was polluted by refuse from a creamery, although other sources of contamination existed. One feature of the defense was the public usefulness of the creamery, which made it advisable to countenance some inconvenience due to its operation. "It is not the policy of the law," the court decides, "to give countenance to a rule the proximate result of which would be to block, if not to stop altogether, the wheels of progress. It is nevertheless true that one may not create a nuisance, and justify himself in a continuation thereof, on the ground that his establishment is the source of benefit and profit to the community; and, as applied to a water-course, the true rule is that a nuisance is created when the use of the stream by the first user is unreasonable in character, and such as to produce a condition actually destructive of physical comfort or health, or a tangible, visible injury to property."

The Evolution of the Practice of American Bridge Building.

Presidential address by C. C. Schneider before the Cleveland Convention of the American Society of Civil Engineers.

In the time-honored custom of an address by the president at the annual convention of the American Society of Civil Engineers, many of my predecessors have selected topics with which they were most familiar. My life work naturally suggests to me the title of this address.

The magnificent stone bridges and aqueducts built by the Romans bear evidence that the art of bridge building had reached a high degree of perfection among the ancients. Some of the early Roman structures were of gigantic proportions, and have not been excelled by any of those built in modern times. There are no records to show that the ancients had any theoretical knowledge of bridge construction; they built their bridges in accordance with empirical rules developed by experience. These monuments of engineering skill, which have lasted for thousands of years, appear marvelous to the modern engineer, who has at his command, not only theoretical knowledge, but also mechanical appliances and modern tools to assist him, which were not known in ancient times. The progress, therefore, made in the art of constructing bridges of stone in modern times appears insignificant, and is practically confined to theoretical knowledge and improvements in machinery and tools for handling material.

The development of the art of bridge construction is marked to a certain extent by periods coincident either with the introduction of new materials or with the necessities arising for means of transportation. The marvelous progress made in bridge building in the 19th centurry—the century of engineering, of the manufacture of power, of the railroad and the telegraph—really began with the production of wrought iron in large quantities, and has since kept pace with the development and progress made in the manufacture of those most useful and precious of all metals, wrought iron and steel.

Wooden Bridges.—The various types of bridges which have survived and become the standard types of the present day are the results of the evolution of a century, originating with the wooden bridge, the wooden beam being the prototype of the modern plate girder, and the framed wooden truss that of the steel truss. Timber bridges, consisting of hewed logs, supported by piers of piling or of stone, were erected in the earliest times in all countries where timber was abundant, Caesar's bridge across the Rhine was of this character. The wooden bridge consisting of framed trusses is the product of more modern times. In Europe, wooden truss bridges of small span, patterned after existing roof trusses, have been built for several centuries. In America, however, it was not until the end of the 18th century that the movement began to which the present type of bridges can be traced.

There appear to be no records of any wooden bridges in America before 1785, when unusually gifted men like Palmer, Burr, Wernwag and others commenced to build some very remarkable wooden structures. The progress made in bridge building in this country was very slow until railroad building commenced, which was in 1829, when the construction of the Baltimore & Ohio R. R. was begun. The first wooden railroad bridge was built on that road in 1830 by Wernwag, at Monaguay. The development of railroads naturally created a demand for bridges. The difficulties and obstacles encountered in crossing long and deep valleys were overcome by these pioneer railroad builders by erecting temporary timber trestles in place of expensive embankments or viaducts, to be filled in or rebuilt by permanent structures at a later period. The timber trestle, therefore, is a distinctly American type of construction, and is the prototype of the iron viaduct. Some of the first high wooden trestles were built in 1840 on the Little Schuylkill & Susquehanna R. R., now the Catawissa Branch of the Philadelphia & Reading Ry. They were designed by James F. Smith, and their heights varied from 60 to 130 ft.

The forms of timber trusses of different kinds, arches and combinations of two or more systems, have been very numerous. A marked step toward bridge designs of the modern truss form was the lattice bridge patented by Towne in 1820, which became the prototype of the early iron lattice bridge. The next important step in the development of wooden bridges was made in 1840, when Howe patented his truss, which became very popular and the standard for wooden railroad bridges. In 1844, the Pratt truss was patented, which afterward became the favored type for iron bridges. Many other types of trusses were invented, which have since been discarded.

The earliest wooden bridges were built by expert carpenters. The work was done by contract, very much the same as building work is done at the present day, except that the builder was also the designer. The builder would buy suitable timber or have it sawed to order at conveniently located saw-mills, and any iron work needed in the construction of the bridge, such as rods, bolts or bars, he would obtain at a local blacksmith shop, and frame and erect the bridge in place, ready for traffic. The same methods were also used in building the early iron highway bridges. Each of these builders had his own type of bridge and his own special details. At that time there was generally but little competition, as very few had any knowledge of bridge building, and each one controlled a certain territory. All the early railroad bridges were wooden structures built by practical carpenters, in most cases employees of the railroad company.

Early Iron Bridges.—England is considered as the pioneer country of the iron bridge, the first one, consisting of a nearly semi-circular cast-iron arch, having been built in 1776-79. In 1786, Thomas Paine, the well--known author, designed and made a model of a segmental arch. This model was set up at Franklin's house in Philadelphia, whence it was taken to the State House, and, eventually, was sent to Paris and exhibited at the Academy of Sciences. Paine had an experimental cast-iron bridge built in England in 1790, and Rowland Burdon, in 1793 to 1796, built the bridge at Wearmouth, of 240 ft. clear span, after this model, which formed the basis of many cast-iron bridges built thereafter, and became the prototype of the modern steel arch. Paine's device was also the basis of the design of the Market St. Bridge and the first Fairmount Bridge, in Philadelphia, both being wooden arches. The former was completed in 1800, and the latter in 1812.

Up to 1840, there were no iron bridges in this country, except suspension bridges in which iron links were used in the cables and suspenders, the floor system being of wood. The first bridge in America consisting of iron throughout was built in 1840 by Earl Trumbull over the Erie Canal, in the Village of Frankfort, N. Y. In the same year Squire Whipple, Hon. M. Am. Soc. C. E., also built his first iron truss bridge.

Probably the first iron railroad bridge was built on the Philadelphia & Reading R. R. at Manayunk by Richard B. Osborne, chief engineer, in 1845. It was a double-track through bridge, of 34 ft. clear span, of the Howe truss type, with cast-iron top chord and web braces, the bottom chord and vertical web members being of wrought iron. This bridge was followed by several others of the same type.

The earlier wooden and iron bridges were built very much in the same manner as the ancient Roman bridges, in accordance with empirical rules, by practical men who had no accurate knowledge of the strains produced on the various members of a structure by the exterior forces, but who were men of unusual constructive ability and sound judgment, who had to depend upon their own resources and natural instinct, experimenting with models and profiting by previous failures. Practice always preceded the science; thus the structural systems were invented before their theory was developed. Until 1847, when Squire Whipple, the modest mathematical instrument maker, who, without precedent or example, evolved the scientific basis of bridge building in America, correct methods of computing the strains in framed structures were not known. A few years later, in 1851, Herman Haupt published a book on the theory of bridge construction.

About 1850, after the building of railroads had advanced, the educated engineer commenced to exert his influence in the art of bridge building, and, from that time forward, steady progress was made. The period from 1850 to 1860, therefore, may be regarded as an epoch in the history of American bridge building; the time when the bridges designed by Fink and Bollman first came into use, and the earliest iron Whipple and Pratt trusses were built.

When American engineers commenced to build iron bridges, they paid little attention to the then existing European models, but preferred to develop their own systems independently, as they had done previously with wooden bridges, the first iron bridges being imitations of the Towne lattice, and the Howe and Pratt trusses. All the earlier bridges were built principally of cast iron, wrought iron being used in tension members only. In the first iron viaduct built by the Baltimore & Ohio R. R., in 1852, all parts were of cast iron, except the tie-rods. The wrought-iron tension members at that time usually consisted of round bars with screw ends, or elongated links made of square bars. Later, these links developed into forged eye-bars, introduced by J. H. Linville, M. Am. Soc. C. E., in 1861. These eye-bars have since become one of the distinctive features in American bridge construction. Although flat eye-bars were used in Europe at an earlier period, in chains of suspension bridges and in some types of trusses, they did not find favor there, and were soon discarded for structures with riveted connections.

The first bridges made entirely of wrought iron were those of the riveted lattice type which Howard Carroll, then assistant to George E. Gray, Hon. M. Am. Soc. C. E., chief engineer of the New York Central R. R., commenced to build in 1859; next came the plate-girder type, the first of which was built by E. S. Philbrick, M. Am. Soc. C. E., for the Boston & Albany R. R. in 1860.

The bridge built by J. W. Murphy in 1863, over the Lehigh River at Mauch Chunk, for the Lehigh Valley R. R., was the first pin-connected bridge constructed entirely of wrought iron in its main members; cast iron being used only for joint boxes connecting the compression members. Many bridges of similar construction were built after this, but it was not until after the failure of the Ashtabula Bridge, in 1876, that cast iron was entirely discarded as too unreliable a material to be used in any parts of a railroad bridge.

Bridge Designing.—Prior to 1860, railroad bridges were generally designed by the railroad companies' engineers, the iron work being manufactured at the companies' shops, and erected by their own forces. Thus, men like Wendell Bollman, Albert Fink, past-president Am. Soc. C. E.;

C. Shaler Smith, M. Am. Soc. C. E., and C. H. Latrobe, M. Am. Soc. C. E., on the Baltimore & Ohio R. R.; Richard B. Osborn and Charles Macdonald, M. Am. Soc. C. E., on the Philadelphia & Reading Ry.; J. H. Linville, on the Pennsylvania R. R.; E. S. Philbrick, on the Boston & Albany R. R.; George E. Gray, Howard Carroll and Charles Hilton, on the New York Central R. R.; Willard S. Pope, M. Am. Soc. C. E., on the Chicago & Northwestern R. R.; Thomas C. Clarke, past-president, Am. Soc. C. E., on the Chicago, Burlington & Quincy R. R.; S. S. Post, M. Am. Soc. C. E., on the Erie R. R., were prominent railroad engineers who took a leading part in early bridge building.

Later, some of the men who had gained experience in framing and erecting bridges, or in the construction of the work at the shops, started in business for themselves, and took contracts to build and erect bridges on designs furnished by the railroad companies' engineers. Most of those early firms were contractors for building Howe truss bridges, only a small shop being required to manufacture the ironwork needed for structures of that class. Some of the bridge engineers employed on railroads, seeing that they could use their knowledge to better advantage in the more profitable business of contracting, associated themselves with the then existing bridge building firms, or organized new companies. These new companies often made a specialty of manufacturing constructions of a certain type, expressing the individuality of the engineer at their head, and which were his own inventions, in many cases controlled by patents. They were able to furnish designs for bridges, as well as construct and erect them. Most of those companies were organized between 1860 and 1870, which period, therefore, forms another epoch in the history of American bridge building.

Near the end of the sixties, when most of the early bridge companies had been formed, there were, besides the engineers interested in bridge building firms, only a few experienced bridge engineers in this country. The engineers who were at that time connected with bridge companies were mostly men who had gained their experience in the employ of some railroad company, had worked out their own type of construction, and had experience, not only in designing, but also in superintending the construction and erection of bridge work. Their theoretical knowledge, measured with the present standard, was limited to elementary methods, but their thorough practical training enabled them to combine theory and practice to the best advantage. They understood how to make their designs conform to the methods of the workshop, as well as to facilitate erection.

This was really the beginning of the development of American bridge building and of the distinctly American types of construction which at that time differed so materially from those of other countries. The most distinguishing feature of the methods then prevailing in this country, as compared with those of other countries, the influence of which is felt to the present day, is that at that time in America the bridges were designed by experienced specialists, and the work was constructed in shops built and equipped for that special purpose by experienced mechanics trained in that class of work. At first these companies controlled the work in certain territories, or the contracts were awarded to them on account of the reputation of their engineer. However, as competition became keener, railroads desired to purchase their bridges for the lowest price, and invited several firms or companies to submit tenders on the bidders' own designs, which started the competitive system of designing and bidding on bridge work.

Up to about 1872, specifications, as we now understand the term, were not in general use. An invitation to bid on bridge work would be accompanied by a survey plan, giving the length of the spans, skews, etc., and a statement of the live load the bridge was to carry, generally a uniform load of 1 ton per linear foot, with a factor of safety of 5. The design of the structure and the proportioning of its members and their details and connections were left entirely to the judgment of the builder, and accepted without question by the purchaser. These builders, who at that time were about the only bridge experts in America, were considered authorities, and would assume the responsibility for the design and the strength of the bridge for the specified loading. In other words, the bridges were accepted on faith and on the strength of the reputation of the builder.

From 1864 to about 1874, the designing of bridges was almost entirely in the hands of the bridge-building firms, only a few railroads, such as the Pennsylvania, and Boston & Albany, employing their own bridge engineers to prepare the designs and to supervise the construction of bridges and other structural work on their respective roads. The contracts for bridges were then let on a lump-sum price for the work erected in place. It was therefore to the interest of the bridge builder to make designs which would reduce the cost of shop work, as well as that of erection, and, as the price of wrought iron was high, as compared with the price of steel at the present time, the saving of material was one of the most important considerations in the designing of bridges.

At that time railroad construction had commenced to develop rapidly in all parts of the country, and many wide and treacherous rivers had to be spanned with bridges. The material for these bridges had to be transported to distant places, erected in unsettled locations, and the iron work manufactured and erected rapidly in order to keep pace with the swift progress made in the building of railroads. As the pin-connected type fulfilled, more than any other, these requirements, viz., economy in weight and facility in manufacture and erection, thereby not only reducing the cost, but also the risks and dangers of erection, it became the favorite type of bridge, and has remained so for long spans to the present day.

Specifications.—The first more comprehensive specifications were those published by Clarke, Reeves & Co., in 1871. In 1873, George S. Morison, past-president, Am. Soc. C. E., prepared specifications for the Erie R. R., which were probably the first printed specifications for iron bridges adopted by any American railroad. In 1875, L. F. G. Bouscaren, M. Am. Soc. C. E., wrote specifications for the Cincinnati Southern Ry., the first in which concentrated wheel loads were specified for the live load. Mr. Morison established the practice, on the Erie R. R., of requiring the successful bidder to submit strain sheets and plans for approval before ordering material or commencing work. These plans, before being approved by the chief engineer, were examined by one of the assistant engineers, and, later, the material and workmanship were inspected by men in the employ of the railroad. The same practice was also adopted by Mr. Bouscaren on the Cincinnati Southern Ry.

The year 1873, therefore, may be considered as marking the beginning of another epoch, viz., that of the bridge engineer as again acting in the interests of the railroad company, and also the beginning of the inspection of structural iron work. Before that date the St. Louis Bridge was probably the only case on the construction of which inspectors of material and workmanship were employed

Many new bridge companies were established after 1874, some of which had a marked influence in the development of American bridge construction, as well as in the improvement of tools and machinery, resulting in a higher grade of work.

Some of the engineers who had gained experience in the employ of bridge companies obtained positions on railroads as bridge engineers; others, particularly the most competent, left the employ of bridge companies for private practice, and devoted themselves to the specialty of structural engineering, acting in the interests of corporations and municipalities or other purchasers of iron structures. These corporations commenced to realize that it would be to their advantage to have the services and advice of competent specialists. Thus, in 1876, the existence of the bridge engineer and structural expert, independent of a bridge company, had become an established fact.

After iron railroad bridges had been in service for about twenty years, engineers who had charge of their maintenance noticed that weak points developed under traffic, particularly in the details and connections. It also became apparent that the bridges built, up to about 1875, were deficient in rigidity and lateral stability, and improvements were gradually made to remedy these defects, producing more massive construction, fewer and heavier parts, and a more extensive use of riveted connections.

The pin-connected type of truss for short spans was gradually discarded, the plate girder and riveted truss taking its place, and the limiting length of spans for these types was gradually increased. Specifications for iron bridges were also revised and improved; those prepared in 1877 by Charles Hilton for the Lake Shore & Michigan Southern, and by C. Shaler Smith for the Chicago, Milwaukee & St. Paul R. R., and in 1879 by Theodore Cooper for the Erie R. R., being steps in that direction.

Steel.—Steel, as a structural material, was first used in a portion of the St. Louis Bridge, completed in 1874, but the first bridge built entirely of steel was the Glasgow Bridge, over the Missouri River, completed in 1879.

The extensive use of steel, however, did not commence until 1890. Before that time steel was used only in isolated cases, or for heavy work, such as chords and eye-bars for large spans.

About 1890, some railroads commenced to build also smaller spans and plate girders of steel, and, for eye-bars, steel was almost exclusively used. At that time most of the rolling mills, which had formerly manufactured wrought iron, were equipped with steel furnaces, but continued for some time to make both kinds of material, until they found it more profitable to confine themselves to the manufacture of structural steel only, and discontinued the manufacture of wrought iron. In 1894, it was practically impossible to obtain wrought-iron shapes, and from that time forward steel entirely superseded wrought iron as the modern structural material. The year 1894, therefore, may be considered as the commencement of the present epoch—the steel age.

The use of steel in the construction of modern bridges, and the improvements made in its manufacture, thereby reducing its cost and increasing its reliability, have made it practicable to build structures of a magnitude never attempted before. Its introduction as a structural material had a marked influence on the progress and development of bridge building. Certain types of construction and details which have proved unsatisfactory have been discarded, and others which have undergone a process of purification and improvement have survived. Rational types of construction and details are now established, and have become the recognized standards for ordinary bridges of moderate spans. The present tendency is toward uniformity, and to-day there is but little difference between the designs made by competent engineers.

This tendency toward uniformity has also been extended to specifications for bridges and other steel structures, relating to quality of material, workmanship and unit strains. As late as five years ago, the requirements specified for the quality of steel were numerous, almost every railroad or bridge engineer requiring some different grade, and sometimes several different kinds in different parts of the same structure. Erratic specifications are now gradually disappearing, and engineers at the present time are nearly all agreed on the grade of steel best suited for structural work.

American and European Practice.—There is also at present more uniformity between the designs made by American engineers and those by European engineers. In the early days of iron bridge building, in this country, there was little resemblance between American and European structures. Each country gradually adopted the good points of the other's practice; we adopted their practice in the use of riveted trusses for longer spans and a more extensive use of riveted connections; while the European engineers are adopting the more rational designs and details of plate-girder and riveted-truss construction now used in America. At the present time, the designs of plate girders and ordinary riveted-truss bridges, made in this country, are almost identical with the designs made by the best bridge engineers in Europe, so that no vital difference now exists between American and European bridges of moderate spans.

The steady increase in the weights of locomotives and rolling stock has been the cause of constant replacements of iron and steel railroad bridges by heavier structures. As the extreme limit of loads may not yet have been reached, the probable future increase should be anticipated in designing new bridges which have to carry any kind of railroad traffic. While it is impracticable to provide for all possible emergencies, railroad bridges should be designed to withstand the ordinary contingencies of traffic, such as derailment, a broken axle or a collision on the bridge. Structures designed in accordance with good practice may be damaged by such accidents, but should be able to stand up without collapsing.

As steel is practically an indestructible material, if kept from corrosion, there is no good reason why properly designed steel bridges, properly protected, should not last at least as long as stone bridges in this climate.

About 1886, a new type of iron structure came into existence, viz., the iron skeleton construction for buildings, which has opened a new field for the structural engineer. The designing and construction of the structural part of these buildings has now become an important branch of engineering.

Contracts for Bridges.—Any engineer who has followed the progress of American bridge building for the last 35 years must have observed that, not only the designs, but also the methods adopted for accomplishing results, have undergone a vast transformation; while, abroad, the designs have been improved, but the methods have changed very little, if at all.

The practice of having the designs of bridges and other structures made by engineers employed by the purchaser, and letting the contract to a manufacturer on a pound-price basis is now becoming the standard practice of the country. Most of the large railroads have their own bridge and structural departments, or, for work of unusual magnitude, employ outside experts to design and supervise construction. Only a few of the smallest railroads adhere to the ancient practice of inviting manufacturers to submit competitive designs accompanied by a lump-sum bid.

The competitive system has had its day and has served a good purpose. It has been an important factor in developing the art of bridge building in America. It has been productive of establishing rational types, practical details and scientific proportions; it has united theory and practice. However, at present, it is fast becoming a thing of the past. What is left of this practice is mostly confined to bridges for electric railways and light structural work. Many purchasers of structural work, who have had no experience themselves, do not seek professional advice, as they would in other cases where large expenditures of money are involved, believing that they can save the money paid for professional services by inviting manufacturers to make competitive designs accompanied by a lump-sum bid. The fact is, however, that the manufacturer has to pay for making the designs not only once, but many times over, as only once in a number of cases is he the successful bidder. The manufacturer will naturally add this extra expense to the cost of the structure, yet the designs are not made in the interest of the purchaser, but in that of the manufacturer. This practice has a demoralizing influence, as it puts a premium on the poorest design and tends to decrease the professional standard of an important branch of engineering.

The standard practice to be recommended, as the only fair and business-like method, is to let contracts for structural steel work on a pound-price basis, on designs and specifications furnished by an experienced engineer employed by the purchaser. This method is fair to the honest manufacturer, as all competitors bid on the same basis; it is an advantage to the purchaser, as he employs the engineer who will protect his interests, study the conditions and requirements, and design a structure to suit the needs of his client. It will benefit a number of engineers, who are now compelled to waste their time and energies in making speculative designs to suit the commercial interests of a manufacturer, regardless of good practice, by elevating them to more independent positions, thus enabling them to raise their professional standards to the highest ideals of good practice.

Plans for bridges and other structures, on the safety of which the lives of human beings depend, should be designed and not manufactured; their design and the supervision of their construction should be entrusted only to competent engineers, who, besides the requisite theoretical and practical knowledge, should, above all, be endowed with common sense and good practical judgment.

Most of the largest bridges and other steel structures which have been built in later years have been designed by engineers not connected with manufacturing establishments. The manufacturer should confine himself to his legitimate field of manufacturing structural steelwork at so much a pound.

The line between engineers and manufacturers will be even more marked in the future, when the same distinction will prevail as now exists between the architect and the contractor. The manufacturers of structural work, in the future, will devote their energies to improvements in their tools and machinery and methods for handling material. Their engineering force will consist of mechanical experts, shop draftsmen and engineers, who, with a thorough knowledge of shop-practice, are skilled in putting the engineers' designs into convenient shape for the workshop.

Patents on structural designs and details, as well as on special shapes, have become unpopular. Designs of important structures, or those with new features, are now generally published for the benefit of the profession, and each engineer endeavors to improve upon the design of the other. Beneficial results are derived from papers, submitted to this Society, illustrating and describing new structures, as they bring out valuable discussions and thereby advance engineering knowledge.

Highway Bridges.—Highway bridges in large cities are, at the present time, generally designed by experienced engineers, and the contracts are let in accordance with legitimate practice, the material and workmanship receiving the same careful inspection and supervision as railroad bridges.

These structures, however, do not represent the general run of highway bridges throughout the country. In 1852, Squire Whipple stated, in a pamphlet published by him, entitled, "The Canal Bridges, a Specimen of the Manner of Awarding Contracts by the late Canal Board," that the highway bridges over the New York State canals were let to the highest bidders and on the poorest designs submitted. The same conditions exist to some extent at the present day.

These bridges are frequently designed by incompetent or unscrupulous men, and the contracts are awarded by ignorant county officials, without the advice of a competent engineer. The merit of the design receives generally no consideration, and the contract is awarded in many cases to the one offering the poorest design and making a bid which is satisfactory to the officials, if not to the taxpayers. This condition will probably continue, until, after repeated disasters, the public demands that competent engineers design and supervise the construction of county highway bridges, and that the contracts be let in accordance with legitimate practice.

Long-Span Bridges.—Long-span bridges have, of late, not only become more numerous, but their length has been gradually increased, until the long-span bridges of former years are now considered spans of moderate size only. The necessity for the great number of long-span bridges in the United States arose from the fact that many wide navigable rivers had to be bridged where the interests of navigation demanded long spans, or where they were required on account of deep and expensive foundations, or on account of other conditions determining the length of spans. There are now in existence in America about fifty railroad bridges containing simple spans of 400 ft. or more, eighteen of which exceed 500 ft., the longest one being the Ohio River Bridge at Louisville, with a span of 546 ft., completed in 1894; there are also a number of highway bridges exceeding 400 ft. span. The length of spans practicable for simple trusses has not yet been reached.

Suspension Bridges.—Suspension bridges were in use in America before any other type of iron bridges. In the earliest suspension bridges, wrought-iron links were used for the cables, and a wooden floor system was suspended from them by iron rods. The first of this kind was built by Finley, in 1796, over Jacob's Creek, on the turnpike between Uniontown and Greensburg, Fayette County, Pa. Many other bridges of the same type were built by Finley after this, the largest one being that over the Schuylkill River, at Philadelphia, Pa., of 306-ft. span, built in 1809. The first wire-cable suspension bridge was also built over the Schuylkill River, at the Falls in Philadelphia, Pa., in 1816; the span was 408 ft. This bridge had a wooden floor system and no stiffening trusses. After this, the wire-cable suspension bridge with auxiliary stiffening trusses became the favorite type for long-span highway bridges, owing to the facility of its erection.

Many famous long-span bridges have been constructed of this type, such as the bridge over the Ohio River, at Wheeling, 1,010-ft. span, built in 1855; the bridge over the Niagara River, at Lewiston, 1,040-ft. span, completed in 1850; the bridge over the Niagara River, carrying the Grand Trunk Ry. and the highway, 821-ft. span, completed in 1855. This bridge has become famous as being the only wire-cable suspension bridge carrying highway as well as railroad traffic. The bridge over the Ohio River, at Cincinnati, 1,000-ft. span, completed in 1867. The bridge across the Niagara River, below the Falls, at Clifton, 1,264-ft. span, finished in 1867. The most notable suspension bridges, however, are the Brooklyn and Williamsburg Bridges, across the East River, New York City. The Brooklyn Bridge, 1,595-ft. span, completed in 1883, was the first bridge of this kind in which steel was used for the cables, suspenders, stiffening trusses and floor system. The Williamsburg Bridge, 1,600-ft. span, completed in 1904, is the latest of the long-span suspension bridges. The proposed Manhattan Bridge, across the East River, New York City, 1,470-ft. span, is also of this type, a novel feature being the hinged steel towers.

Suspension bridges with braced cables in place of auxiliary stiffening trusses, the cables consisting of forged eye-bars, have also been successfully used for long-span bridges. The Point Bridge, over the Monongahela River, at Pittsburg, an 800-ft. span, completed in 1876, is a bridge of this kind.

In locations where the appearance of the structure is one of the most important considerations, this type eventually may take the place of the cantilever for long-span railroad bridges.

Metal Arches.—Metal arches are particularly suitable for long spans in certain places. The arch combines the advantages of a graceful appearance with facility of erection without falsework. Most of the earlier ones were constructed of cast iron, an important example of which is the Chestnut St. Bridge, in Philadelphia, completed in 1863. The first important steel arch was the St. Louis Bridge, over the Mississippi River, completed in 1874, consisting of three spans, the middle one, of 515 ft., being the largest. The highway bridge across the Mississippi River, at Minneapolis, having two spans of 456 ft. each, was completed in 1888. The Washington Bridge, across the Harlem River, New York City, finished in 1889, consists of two spans, each of 510 ft.

A number of arches of various types followed, the most noted of which are the two across the Niagara River, one of which, of 550-ft. span, carries the tracks of the Grand Trunk Ry. and a highway, replacing the Roebling suspension bridge. It was constructed in 1897. The other replaced the Niagara Falls and Clifton Suspension Bridge in 1898. It has a span of 840 ft., and is the largest arch of any type in the world.

Cantilever Bridges.—Cantilever bridges are generally suitable for long spans only; where the length required is too great for a simple truss, or where it becomes necessary to erect without temporary supports, and the conditions are not favorable for an arch. It, perhaps more than any other kind, has been erected in places where simple trusses would have been more appropriate, and freaks of this kind may be seen in various places.

As the cantilever bridge is not as economical as a simple truss, except for spans of great length, and as simple trusses in many cases can be erected on the cantilever principle, the simple truss is generally preferable to the pure cantilever type. The Atbara Bridge, and the bridge recently erected over the Ohio River on the line of the Baltimore & Ohio R. R. at Benwood, are examples of this kind of construction.

The first cantilever railroad bridge was the Kentucky River Bridge, of three spans, each of 375 ft., completed in 1877, on the line of the Cincinnati & Southern Ry.

Many other cantilever bridges were built thereafter, such as the Niagara River Cantilever Bridge, on the line of the Michigan Central R. R., 470-ft. span, completed in 1883. The Fraser River Bridge, on the Canadian Pacific Ry., in 1884, 315-ft. span, and the St. John's River Bridge, in 1885, 477-ft. span. The Poughkeepsie Bridge, across the Hudson River, including a span of 523 ft., finished in 1889. The Colorado River Bridge, at Red Rock, Colo., 660-ft. span, completed in 1890, and the Memphis Bridge, with a span of 790 ft., completed in 1892.

The latest and most conspicuous cantilever bridges constructed are those over the Monongahela River, on the line of the Wabash R. R., at Pittsburg, 812-ft. span, and at Mingo Junction, 700-ft. span, completed in 1904; also the Thebes Bridge, across the Mississippi, 671-ft. span, completed in 1905. The bridge over the East River at Blackwells Island, now under construction, has spans of 984 and 1,182 ft., respectively.

The longest cantilever bridge is that across the St. Lawrence River, at Quebec, with a span of 1,800 ft., now being built. This will make it the longest cantilever bridge in the world.

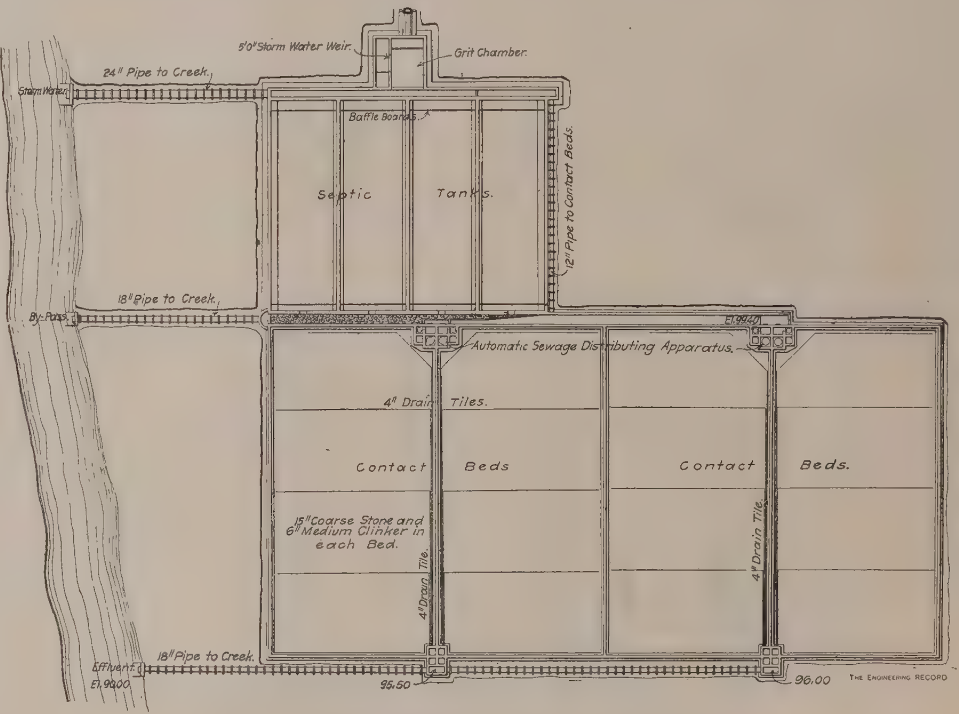
At the present rate of development of bridge building, with the materials at our command, we may see even longer spans in the near future. It is entirely feasible to build simple trusses of 800 ft., arches and cantilevers of 2,000 ft., aand wire-cable suspension bridges of 3,000-ft. span.

Monumental Bridges.—Bridges of monumental nature have generally not received the same careful attention in this country as in Europe. There is really not much difference between public buildings and other public works of like importance. While public buildings have been designed for appearance as well as for permanency, public bridges have been notoriously neglected in both respects. Thus in large cities we see many bridges, which are far from being ornamental or sightly in appearance, situated in prominent places and in public parks in the midst of beautiful landscapes.

Such structures, which are in many cases the most prominent objects in a city, should be monumental in character, and designed on æsthetic as well as on engineering principles. Fortunately, in later years, there has been a manifest tendency toward improvement in this direction.

Any experienced bridge engineer is competent to decide upon the proper design of a structure, wherein utility and economy are the only considerations, but not if the structure requires æsthetic treatment, as engineers are generally deficient in æsthetic training. In the design of a structure of monumental character, the engineer should co-operate with a competent architect, who should be a true artist and not merely a decorator.

The best results can only be obtained by a competition, such as is the usual practice with other monumental structures, the jury of selection to be composed of engineers and architects. This method was adopted in the selection of designs for the proposed Memorial Bridge and the Rock Creek Bridge at Washington, and has proved very satisfactory.



Plan of Sewage Disposal Plant No. I, Charlotte, N. C.

The Washington Bridge, in New York City, and the Cambridge Bridge, at Boston (nearly completed), are good examples of monumental city bridges.

Erection.—The erection of structures has kept pace with the rapid progress in structural engineering, requiring the institution of new methods and the development of new appliances demanding engineering skill. The increased weight of members, consequent upon the development of long spans and lofty viaducts and buildings, and the necessity of assembling the members rapidly and economically, often over treacherous streams, while carrying safely, and without interruption, the constant traffic of a railroad, have made the erection one of the most important operations connected with the construction of the various kinds of engineering structures.

The introduction of the traveler was a marked advance in the erection of structures, dispensing with a portion of the temporary supports. Later, the traveler was developed to erect viaducts and bridges of the cantilever type without the use of any temporary supports.

Until recent years the question of erection was left to the skill and judgment of practical men who had gained their knowledge and had become experts by long experience. The field operations in connection with the erection of some of the structures of recent years were of such magnitude and complicated character that it required a high order of engineering skill and experience to carry them out to a successful completion. Erection of bridges and other structures has manifestly advanced from being mere skilled labor, executed by men having only practical training, to be an important branch of engineering.

Nickel Steel.—Nickel steel has of late received special attention, and has been investigated by engineers, in relation to its usefulness as a structural material. For many years, metallurgists have experimented on the effect of the addition of special metals to steel with a view of increasing the ultimate strength and elastic limit of the steel without proportionately decreasing its ductility. So far, as a special structural steel, nickel steel is the only one which has proved satisfactory.

Nickel steels of varying carbon and nickel have been successfully used during the last fifteen years for marine and stationary engine shafting, locomotive axles, piston rods and crank-pins, and a wide variety of forgings and castings for parts of machinery. Its application for the manufacture of armor plate, since 1890, is well known. It has recently been adopted, especially in this country, for gun forgings. It has been proposed for structural work before, but is now actually used for bridge construction in the eye-bars for the Blackwells Island Cantilever Bridge across the East River, New York City, and may take an important place as a structural material for long-span bridges.

Controlling Apparatus between Septic Tanks and Beds, Charlotte, N. C.

Concrete Construction.—Concrete construction has been in use for many years, but is used more extensively now than formerly for foundations, piers and abutments, as well as for bridges. Marked progress was made in concrete construction when the methods of reinforcing concrete with steel were introduced. Concrete arches reinforced with steel ribs or bars, properly designed and constucted, have proved satisfactory for highway as well as railroad bridges, and are gradually superseding those of masonry construction.

Reinforced concrete is now used successfully in the construction of floors of bridges and buildings. It has also proved satisfactory for fireproofing and as a protection, to the steel work of bridges over railroad tracks, against the corroding influence of the gases from locomotives, and will probably take a permanent place in structural work in the future.

Contracting.—Contracting has undergone a marked development to keep pace with the advances made in bridge building and structural engineering. Deep and difficult foundations for bridge piers and high buildings are more frequently required now than in former years, and while the engineer furnishes the design, it devolves upon the contractor to devise ways and means for doing the work. Many of the problems the contractor has to solve require engineering talent of the highest order, and some of the contractors' engineers are men of exceptional ability and of high standing in the profession.

Conclusion.—From the foregoing short review, it is evident that this country has been an important factor in the development of the art of bridge building in modern times.

In timber bridges, America has excelled all other countries. Many famous bridges were built during the period when timber was the principal material of construction. Bridges such as the "Colossus" Bridge, over the Schuylkill at Fairmount, Philadelphia, the Cascade Bridge and the Portage Bridge, on the Erie R. R., and many other structures, which were masterpieces of work in timber, are considered at the present day marvels of genius and skill in the art of carpentry.

America is the country where the first design and model of a cast-iron arch, which may be considered the prototype of the modern steel arch, was made in 1786, and where was built in 1796, the first suspension bridge with iron chains and suspended roadway, and also the first wire-cable suspension bridge, in 1816.

The first bridge in the construction of which steel was successfully used, namely, the famous St. Louis Arch Bridge, was built in America, and America has the largest number of long-span steel trusses in the world. It has the largest steel arch in existence, namely, the one across the Niagara River, with a span of 840 ft.: also the longest suspension bridge, the Williamsburg Bridge, across the East River, with a span of 1,600 ft.

American engineers are now constructing the largest cantilever bridge, over the St. Lawrence at Quebec, which, as previously stated, will be the longest span bridge in the world.

Sewage Purification Plant at Charlotte, N.C.

By Cecil C. E. Beddoes, Consulting Engineer.

A report of the working of the first Charlotte sewage purification plant, which has been in operation for upwards of twelve months, may prove of interest to many of your readers. Especially will this be the case if it is conceded that, "the sewage problem is essentially a cost problem." This plant, the first outlay for which represents less than $1.25 per head, satisfactorily disposes of the sewage of approximately 10,000 persons, and is maintained in efficient working order at an annual charge not exceeding 1½ cents per capita. It covers less than one acre of ground, absorbs a total fall of but 4 ft. 6 in., operates automatically, and produces a filtrate uniformly non-putrescible, as proved before and after incubation as well as by "the workman's test," with permanganate of potash, made at frequent intervals by the man in charge. This result is obtained in beds 2 ft. deep and notwithstanding that the fluctuations in the dry-weather flow require that the filters treat tank effluent, for several hours at a time, at a rate of upwards of 1,600,000 gal. per acre bed per day.

The city of Charlotte, N. C., has, with the suburbs, a population of about 30,000. The sewerage system has been in use for nine years, and has two outfalls, one discharging into Irwin's Creek to the west, and one into Sugar Creek on the east. The number of persons using each set of sewers is approximately 10,000, and the amount of water used per capita is 30 gal.

Damage suits were brought against the city by property owners on the two creeks, on account of the nuisance caused by the discharge of sewage. After losing their first case and paying $5,000 in damages, the authorities decided to put in some system of purification. I designed and supervised the construction of open septic tanks with single-contact beds, and after the plant had been in operation a few months all damage suits were withdrawn.

The system connected with the tanks is for sewage only, and the maximum dry-weather flow is 33,000 gal. per hour, the minimum flow is 2,000 gal. per hour; owing, however, to poor construction of mains, and from the fact that many of the manholes are submerged in times of heavy rains, the leakage is excessive. I have measured 175,000 gal. flow per hour, leakage, in excess of the maximum dry-weather flow. To avoid this storm water passing through the tanks, a weir was put in the grit chamber, allowing this excess to pass into the creek. This storm water is, no doubt, at least for the first rush, a weak sewage, and might possibly in some cases require purification, but in the case in question this was unnecessary.

The septic tanks are four in number, each 64 ft. long, 20 ft. wide, side walls 7½ ft. high, having a depth of sewage of 6 ft.

The sewage passes from the grit chamber into three tanks, thence through coarse rock, in the feed channel, back through the settling tank, and thence on to the contact beds.

The average rate of flow through the first three tanks is 1 ft. in 13 minutes, and through the settling tank 1 ft. in 4½ minutes.

By using the tanks in series I obtain the following advantage: The thickness of the skin on the septic tanks, which will bear the weight of a man (see photo), confines the escape of gas to the space between the baffle board at the discharge end and the overflow weir, where there is no skin; these gas bubbles are continually bringing up quantities of sludge, which, passing directly on to the contact beds, was detrimental. This sludge is now broken up into fine particles by the rock in the feed channel and passes into the settling tank, to be further acted on by anaerobic action. Only a very thin skin forms on this tank; it seems to have a soothing effect; and last, but not least, I have no more trouble with the sludge.

The chemical and bacteriological effects of the change are not appreciable, but there being less solids in suspension in the tank effluent, it follows that the hydrolytic action is going on favorably.

Table of changes in tank effluents in parts per 100,000:

	Three tanks in multiple.	Fourth tank.
Oxygen absorbed in 4 hrs...	2.00	2.12
Free Am.	1.09	1.15
Almuminoid ammonia.........	.229	.217

There is a feature in connection with the movement of matters in suspension in septic tanks that is sometimes overlooked, viz.: the perpetual upward and downward motion due to the conversion of a portion of organic matter into gas and its subsequent liberation to atmosphere. I have watched a piece of skin (or "scum") about 18 in. square that happened to have a piece of lemon peel on it rise and sink 17 times in about two hours, until it was all broken up and the lemon peel sank. The horizontal distance traveled was possibly only 3 ft., whereas assuming the rise and fall to represent 10 ft. (5 up and 5 down) then the vertical travel (170 ft.) was in this instance 56 times that of the horizontal. This would seem to point to the advantage of deeper tanks than are frequently made use of.

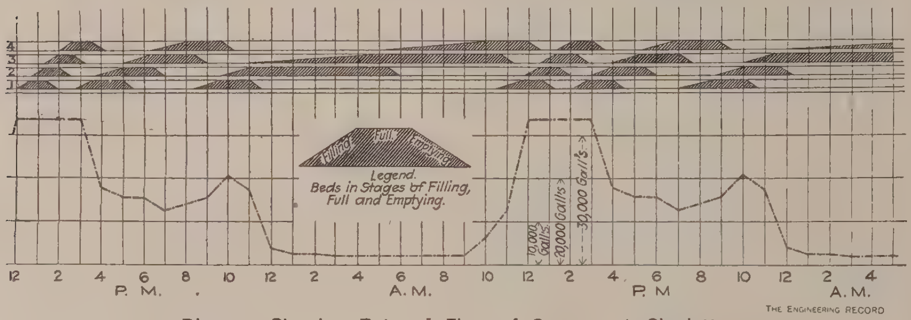
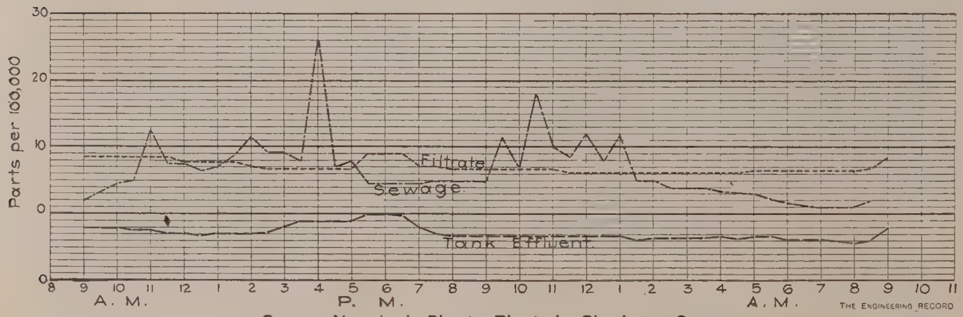


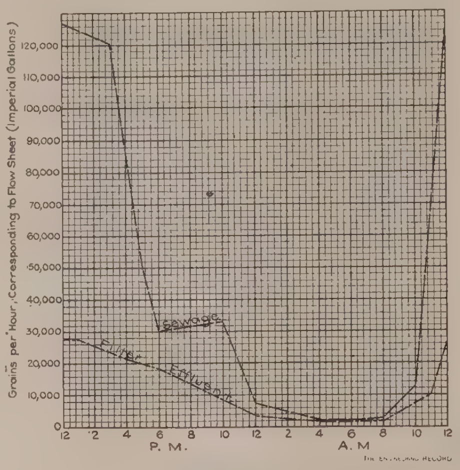
Diagram Showing Rate of Flow of Sewage at Charlotte.



Oxygen-Absorbed Chart, Plant I, Charlotte Sewage.

The contact beds are four in number, each 100 ft. long, 50 ft. wide, with 18-in. rock of a size to pass through a 2½-in. ring, topped with 6-in. medium-size clinkers; the beds are drained by 4-in. round drain tile. I find that a quick discharge is advantageous in securing a more positive aeration of the interstices of the filtering material. If the surface has not been hoed and weeded for some little time, a distinct hissing sound may be heard as the bed discharges and the level of the filtrate rapidly recedes. This indicates a strong suction of air through the clinkers. It may also be assumed that as the bed refills the sewage will pass through the clinkers in fine streams and over the surfaces of the coarse stone in the presence of air and in thin films. The top dressing of clinkers is also of distinct practical usefulness in retaining on the surfaces of the beds matter in suspension not retained or liquefied in the septic tank. The use of this top dressing necessitates a small expenditure for keeping the beds in good condition, but I consider this is more than offset by the fact of the excellent distribution secured and the added length of life given to the beds.

The Merritt automatic air-lock valves control the operation, and have proved very satisfactory. They absorb no fall and are capable of being regulated to suit various conditions. A further advantage in favor of air-locks is that the outlets remain open during the whole of the resting empty period, so that a free circulation of air can take place through the underdrains.



Chlorine Chart.

The time the tank effluent is in the contact beds is, at maximum flow, 40 minutes for each period of filling, period of rest, and emptying, but as to the first two named periods this all depends, as a glance at the flow sheet will show, on the time of day and flow of sewage.

I have made about two hundred analyses, and the chemical results of the plant are shown by the chlorine and oxygen-absorbed charts.

The chlorine chart shows how evenly the sewage is mixed in the tanks, and in fact the tests made on the tank effluent, at any period of the 24 hours, show little variation.

In the oxygen absorption chart I have tried to get a fair average, and have taken the grains of oxygen consumed per Imp. gallon of sewage as the test; the result reduced to parts per 100,000 is in the following table:

Analysis, in Parts per 100,000.

	Sewage.	Tank Effluent.	Filter Effluent.
Oxygen absorbed in 4 hours..	3.87	2.33	1.09
Nitrous nitrogen	0.00	0.00	.017
Nitric nitrogen	0.00	0.00	.217
Ammoniacal nitrogen.........	2.47	1.20	.82
Organic nitrogen	2.21		.594
Total nitrogen	4.68		1.648
Albuminoid ammonia as N.H.	.565	.334	.165

Percentage of purification, by oxygen absorbed, 71.8; by nitrogen oxidized, 73.1; by albuminoid ammonia reduced, 70.7.

Had the local conditions called for a higher percentage of purification this could unquestionably have been obtained by increasing the number of filters and thus lengthening the periods of resting full and resting empty. Or had ample fall been available to allow of the storage of tank effluent so that an equal flow to the beds might take place throughout the 24 hours, this would naturally have been beneficial; as it is, the hours of minimum flow must be depended upon for recuperative purposes. The special object for which this plant was installed has, however, been accomplished. It produces a clear and non-putrescible effluent on a small area (two-thirds acre), conveniently situated. It was constructed at a moderate outlay, and is operated and maintained in efficient working order at an almost nominal cost.

Man Walking on Septic Scum.

If the plant I have described may be credited with features specially its own, perhaps the following may be included: (a) tanks in series 3 and 1; (b) breaking the sludge between them by passing through coarse rocks; (c) shallow filter beds of coarse stone with top dressing of fine material arresting and treating the unhydrolized solids; (d) rapid discharge for insuring better aeration.

Time has not permitted me to carry forward certain bacteriological tests as far as I should have liked, but those I have made incline me to the opinion that shallow contact filter beds are preferable to deep ones for producing healthy liquefying organisms for the destruction of the B. coli communis and other pathogenic germs, the action of which, as Dr. Rideal has pointed out, forms "an important part of natural purification."

The chlorine tests were all made at the works, and every half hour in the 24 some oxygen absorption tests were also made at the works, but as I found little or no change in making these thirty minutes later most of them were carried out at my laboratory. In dry weather the filtrate is perfectly clear. Two bottles, one filled with tap water and one with filtrate, are equally clear. But, inasmuch as the sewers are in a red clay district, the effluent is opalescent in wet weather, due to the number of particles of clay in suspension, which naturally are not acted upon by bacterial organisms and which are so fine that it is impossible for the beds to remove other than those which lodge in the top dressing. Was it not for this storm water the small expense for maintenance would be even lower than it is, as less attention to the top dressing would be required.

A New Mine Water Hoist.

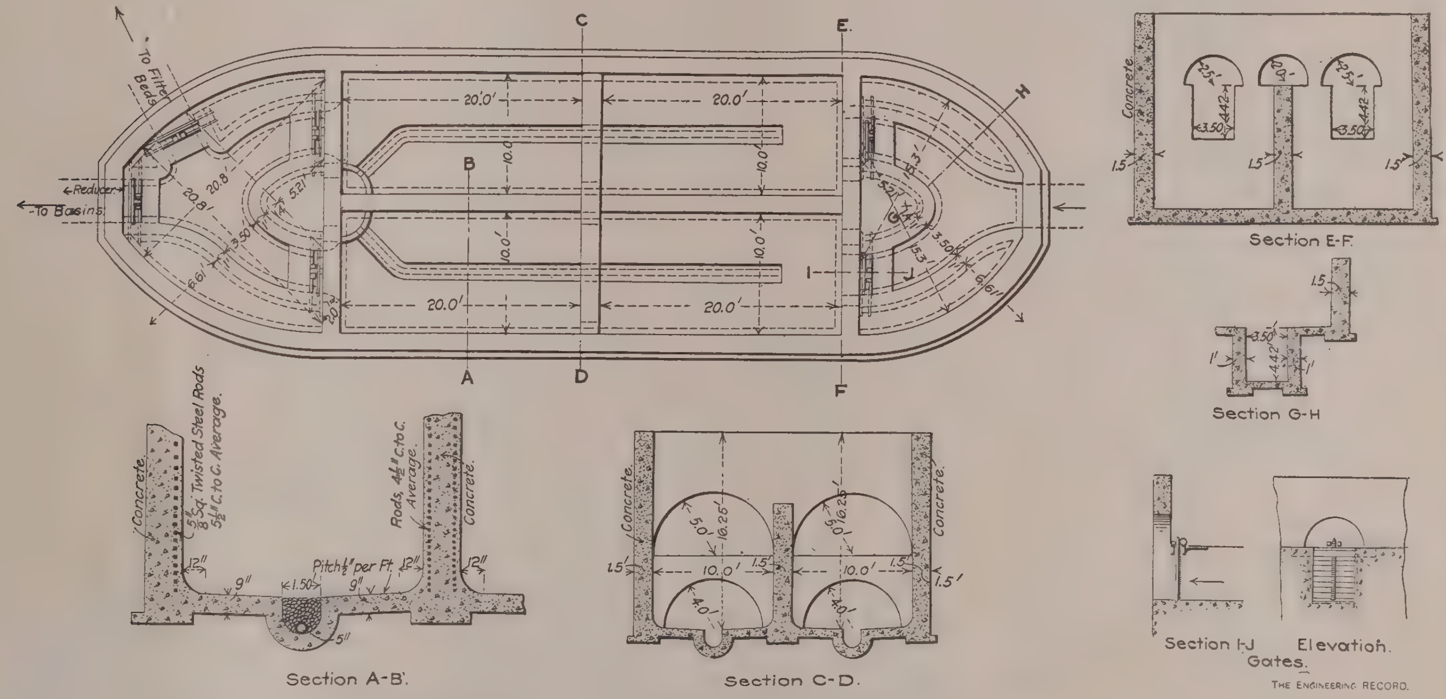
An automatic electrically operated water hoist of an entirely new design has recently been completed at the Hampton workings of the Delaware, Lackawanna & Western R. R. coal mining department. The buckets, of which two are operated in balance from the hoisting drum, are of steel boiler-plate construction, each of 17 tons capacity, and are arranged to automatically discharge the water into a surface basin. The distance of lift is 500 ft., and the complete cycle of hoisting operations of each bucket is 115 seconds. The hoist is operated by an 800-h.p. General Electric three-phase induction motor, which runs constantly, the drum being automatically clutched into connection with shafts gear-driven in opposite directions, as required, for the hoisting and lowering operations. Novel features of unusual interest are incorporated in the design of the friction clutches and their air-operated controlling mechanisms, as well as also in the electro-magnetic controller for controlling the hoisting drum movements through the clutch connection.

A Suburban Route by trolley from New York to New Jersey has been outlined by President McCarter, of the Public Service Corporation of New Jersey. It is to start in Newark, pass under the Passaic River in a tunnel, to Harrison, then across the Hackensack River to Jersey City and under the North River to Manhattan. The running time will be about 30 minutes.

Extensions of the Worcester Sewage Disposal Works.

The works for treating the sewage of Worcester, Mass., before its discharge into the Blackstone River are not only the largest in the country, but are probably marked by the greatest variety of methods actually employed for purification. They were originally built for chemical treatment, and this is still continued, but has been supplemented with intermittent filters, septic tank treatment and recently with a few double-contact beds. From the outset the beds have been under the supervision of chemical specialists; and the peculiar character of the sewage due to the presence in it of iron salts from wire mills, the care with which the operations are managed, and the legal obligations which are connected with the engineering problems, unite in making the works the most interesting as well as the most important in the country.

When the original chemical precipitation plant was built, as illustrated in this journal on March 21, 1891, no provision was made for the collection of the heavy material, such as sand and gravel, which are brought down by the sewage, particularly in times of storm. Accordingly these substances were carried out with the sludge. When the sludge is removed from the basins, it is very difficult to get this heavy deposit to run with the liquid, and therefore it has been allowed to accumulate in the basins, being removed once each year at a considerable expense for labor. Last year, two grit chambers, each 40 ft. long to 10 ft. wide, and designed for a depth of sewage of about 9 ft., were built. They are located directly in line with the outfall sewer, so that all sewage passes through them before reaching the precipitation basins or the filter beds. These grit chambers are built of reinforced concrete, and are arranged in duplicate, so that when one is being cleaned, the sewage may be passed through the other. The accompanying cut gives the details of construction of these chambers.



Plan and Details of Grit Chambers, Worcester Sewage Disposal Works.

There are strong indications, according to the report for 1904, of Mr. Harrison P. Eddy, superintendent of the sewer department of the city, that the best results from intermittent filter beds will be obtained where all the coarser suspended matters of the sewage are distributed over the surface of the filter, instead of being settled out, leaving only the finer particles to be turned onto the filters. To facilitate turning crude unsettled sewage onto the filters the outfall sewer has been extended from the lower end of the grit chamber to the conduit leading from the chemical precipitation plant to the filter beds. By means of this, it will be possible to run the sewage to the filter beds without passing it through any of the precipitation basins, and it is expected that only sand and gravel will be removed by the grit chambers. The area of the cross section of this conduit is equivalent to the area of the outfall sewer, which is 42 in. in diameter. The grade, however, is considerably greater than that of the outfall, and consequently its carrying capacity is also greater.

Contact Beds.—After a very careful examination of various sewage purification plants, the Committee on Sewers decided that it was advisable to undertake a line of experiments with some method of filtration, which would allow of filtering a greater quantity of sewage on a given area of land than had proved possible with intermittent filtration through sand. It therefore recommended to the City Council, and the recommendation was adopted, that filters be constructed for this purpose. Accordingly, there have been built two primary beds, and one secondary bed, each having a superficial area of about 1,200 sq. ft. These beds were completed late in the fall.

Purification.—All of the sewage has been treated during the year either by chemical precipitation, intermittent filtration, or a combination of both methods. The total flow of sewage received at the disposal works amounted to 4,622,000,000 gal., of which 4,227,000,000 gal. have been treated with chemicals and 395,000,000 gal. have been filtered without chemical treatment. Of the chemical effluent, 600,000,000 gal. have been further purified by intermittent filtration. The average daily flow of sewage received was 12,630,000 gal. The quantity of water supplied to the city by the Water Department has averaged 10,170,000 gal. daily.

The cost of maintaining the purification works for the year has been $55,184.15, making a net cost per capita of 40 cents, based on an estimated population of 136,900.

Chemical Precipitation.—The amount of iron received in the sewage has been very variable, and there has not been as much as in previous years, doubtless owing to poor business in the wire mills and foundries. Milk of lime continues to be the only chemical added to the sewage, the amount of lime averaging, for the past year, 1,005 lb. per million gal. This does not include the lime added to the sludge direct, to facilitate pressing.

The net cost of the chemical treatment has been $21,652.93, making the cost $5.12 per million gal. treated. To this should be added the cost per million gal. sewage treated, for disposing of the sludge, $5.83, making a total cost of $10.95.

The sludge produced has been pressed, and the cake hauled over a narrow gauge trolley road to the dump, as in previous years. The total volume of sludge pumped from the settling basins to the storage tanks was 27,019,000 gal. It was allowed to remain in the storage tanks for a considerable length of time, when the clear water was drawn from the top, before pumping to the presses. The amount drawn off was 2,688,000 gal. or 9.9 per cent. of the sludge pumped.

Old Filters.—The original filtration area, consisting of 14.2 acres (see Eng. Record, March 7, 1900) was used throughout the principal portion of the year for the filtration of chemical effluent, although late in the fall, a small amount of crude sewage was filtered on a few of the beds. This area has filtered 128,000 gal. of chemical effluent per acre per day.

The sand and organic matter removed from the surface of these filters since they were first put in operation in 1899. has amounted to 14,421 cu. yds. measured in the filter.

They have received both sewage and chemical effluent at different times, the total amount of water filtered being 4,744,000,000 gal. The average amount of material removed from the surface of the filters during the six years they have been in operation is 3.02 cu. yd. per million gallons of water filtered, or 1,016 cu. yds. per acre. This is equivalent to about 7.56 in. in depth over the entire area.

During 1904 only four of these filters were cleaned, these having run about a year without having any material removed from them. The amount of material removed was 830 cu. yds., measured loose, amounting to 3.55 cu. yds. per million gallons effluent filtered. This would amount to 1.43 in. in depth removed from the surface of the beds measured in the filter. The cost of cleaning these beds this year was $380.13, amounting to $95.03 per acre, $0.458 per cubic yard material removed from filter, and $1.625 per million gallons effluent filtered.

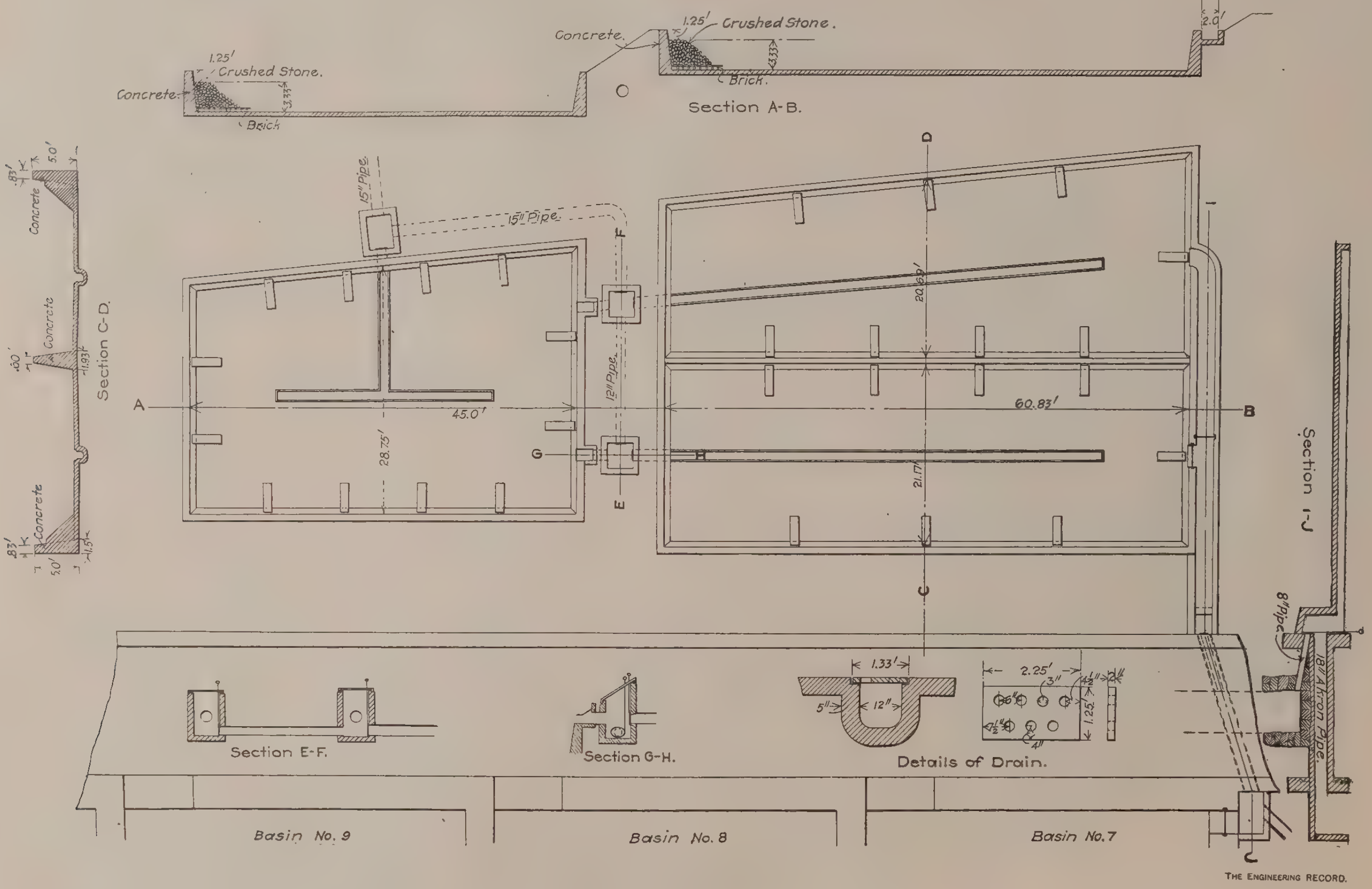
For about a year, it has been apparent that at least some of the under-drains of these filters were becoming clogged. It was found, upon digging up, that the clogging took place in and around the joints in the under-drains, and that the barrel of the pipe was comparatively clear. Examination revealed the fact that the clogging material was composed practically wholly of hydrate of iron, which cemented the joints so that many of them were absolutely water tight, and much of the gravel around the joints was equally impervious to water.

To obviate this trouble, the under-drains were dug up in ten of the filters. The pipes were cleaned and the gravel around the joints was carefully screened. The pipes were relaid, the hubs being completely knocked off, except on the bottom of the pipe, this bottom portion being left to assist in the laying. Three-eighths of an inch free space was left between the ends of the pipes. Coarse gravel was carefully placed around the joints, and finer gravel was spread outside the coarse material. In this way it is hoped that the joints left will be sufficiently large, so that any iron which may be precipitated and reach the joints will be washed out into the under-drain.

New Filters.—On Dec. 18, 1903, nine new sand filter beds were put into operation. These filters were mostly artificial, the sand having been taken from a neighboring bank and spread out upon low swampy land. There were unequal settlements, which allowed suspended solids of the sewage to accumulate in various depressions. This caused a reduction in the amount of water which could be applied to the filter, which, together with the comparatively large quantities of ice formed on those portions of the beds farthest removed from the sewage inlets, explains the comparatively low rate of filtration during the winter months.

At the time the filters were first flowed, the sand was frozen to a depth of 18 in. The sewage, however, disappeared rapidly. On certain portions of some of the filters, the ice finally reached a thickness of 18 to 24 in. As the beds were furrowed, there was no opportunity for the sewage to pass beneath this ice, and the areas thus covered were practically out of use until spring. In spite of this apparent loss of filtering surface, 101,000 gal. of sewage per acre per day were filtered between the date of starting the beds and April 1.

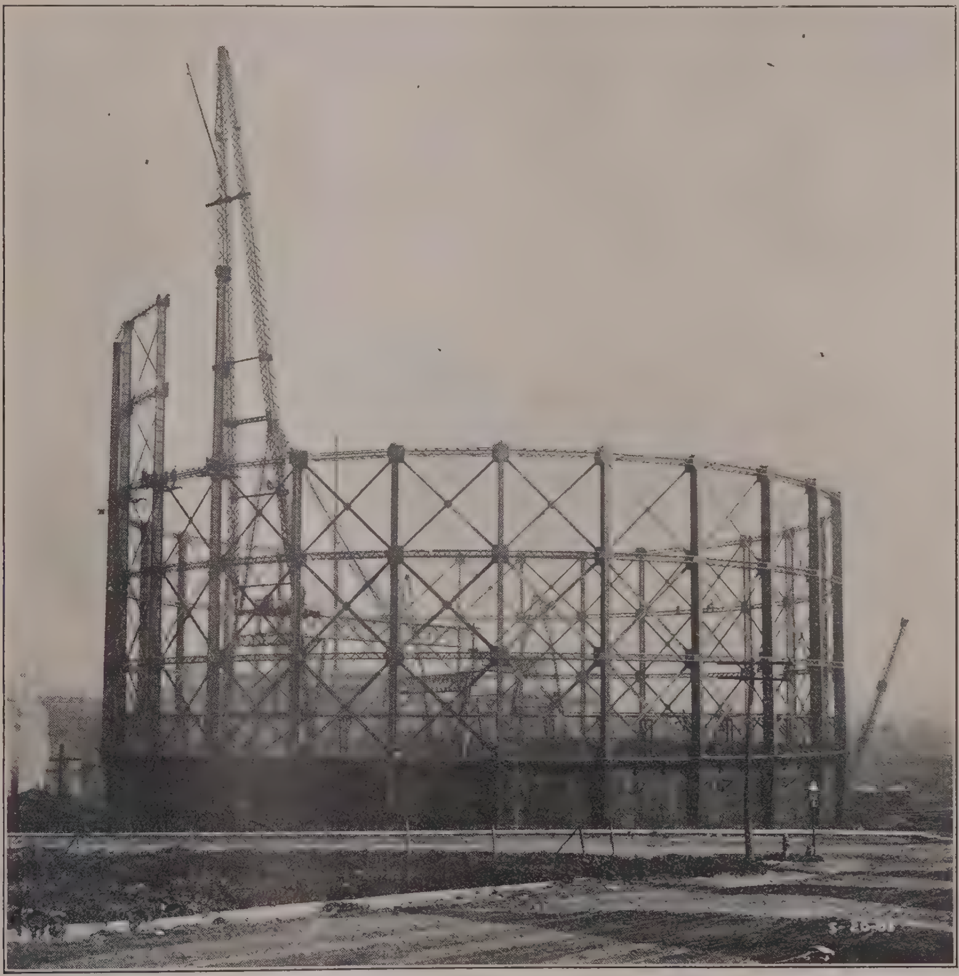
Beginning in December, the weather continued very cold throughout the winter, so that practically no surface cleaning could be given to any of the filter beds. The coldest period was between Jan. 1-7, when the minimum temperature ranged between +8° and —10° F. During this period, the maximum temperature did not exceed 32°, and for three days the maximum did not



Plan and Details of Double-Contact Beds, Worcester Sewage Disposal Works.

rise above 8°. During the entire month of December, the minimum temperature registered no higher than 32°, and reached that point only on two occasions. During the month of January, there was only one day on which the minimum temperature reached a point above 32°. In February the minimum temperature reached 32° only on one day.

The purification effected by the sewage beds during the winter was quite satisfactory, although, as would be expected, nitrification was very low. The poorest results were obtained during the month of March, when the percentage of purification was only 76.98, although the quality of the filtrate was somewhat better than during the first fourteen days of operation in December. The only way to get the crude sewage onto the filter beds was to pass it through at least one of the precipitation basins of the chemical plant. One tank 40 ft. x 166⅔ x 7 ft., was reserved and used only for this purpose. When the sewage was being run to the filters, the chemicals were shut off, and the entire flow from the outfall sewer passed directly through the basin. The flow through this basin was at a rate averaging between fifteen and twenty million gallons per day. About 34 per cent. of the suspended solids was settled out, in spite of the rapid flow, so that the water applied to the filters was not strictly raw sewage. The deposit which accumulated in this tank was removed at frequent intervals so that there was comparatively little fermentation.



Derrick Used in Erecting Milwaukee Gas Holder.

These filters received an average of 125,000 gal. per acre per day from Dec. 18, 1903, to Dec. 1, 1904.

The surface of these beds was cleaned at frequent intervals, to ensure as large a volume of sewage filtered as possible. Care was taken, however, not to mix the surface material with the clean sand below, and no plowing, harrowing or raking was allowed on these beds, with the exception that occasionally the film of organic matter on the surface was carefully broken with a hand rake, to facilitate their draining off. The total amount of material removed from the beds was 1,893 cu. yd., amounting to 6.5 cu. yd. per million gallons of sewage filtered. The total cost of cleaning was $1,170.94, amounting to 62 cents per cubic yard of material removed, and $4.02 per million gallons of sewage filtered up to Oct. 1, after which time no cleaning was done. The cost of operating and cleaning all of the filters, including both those receiving chemical effluent and those receiving crude sewage, has been $8,891.04, making the cost of filtering $8.94 per million gallons. This includes the cost of relaying the under-drains, the cost of all cleaning and operation, and the cost of regrading the nine filter beds put into use in December. This figure also includes a proper proportion of all laboratory and administrative expenses, as do all general costs given in this report.

Four more new beds were put in service in the fall of 1904, making 27 acres now available for filtration.

The quantity of sewage and chemical effluent filtered per acre per day has averaged about 125,000 gal. By the chemical treatment, an average of 49.45 per cent. organic matter, as shown by the albuminoid ammonia, has been removed from the sewage. Suspended organic matter was removed to the extent of 93.7 per cent. By the chemical treatment, the filtration of chemical effluent and the filtration of crude sewage, the net results of analyses combined in proportion to the amount treated in each way, show the removal of 58.80 per cent. The combination of chemical precipitation with subsequent filtration gave a total purification of 90.33 per cent., while the filtration of the chemical effluent gave a purification for filtration alone amounting to 81.63 per cent. The purification effected by passing the crude sewage through one settling basin. with subsequent filtration, amounted to 88.25 per cent., while the filters purified the effluent from the settling basin to the extent of 83.6 per cent., from July to December.

Weekly examinations of the water flowing in the Blackstone River which receives the effluent from the disposal works, have been continued as in the past eleven years. Samples are taken at two points above the purification works and at three points below. The results of the examinations show that, in spite of a reduction in flow in the river of about 12 per cent. over last year, the chemical composition of the water has remained substantially the same. It is also apparent, from an examination of the analyses made during the previous years, that the river is not growing more polluted. This conclusion, however, is not borne out by the results of analyses made in 1904 by the State Board of Health, which indicate that the river has increased in pollution somewhat. It is difficult to reconcile these analyses with those made by the department, and it is believed that greater weight should be given to the latter, on account of their frequency and the fact that samples are taken at three different points below the works, instead of at a single point. In view of the small flow in the river, it would seem that the analyses made by the department would indicate an encouraging change for the better in the condition of the water flowing below the city.

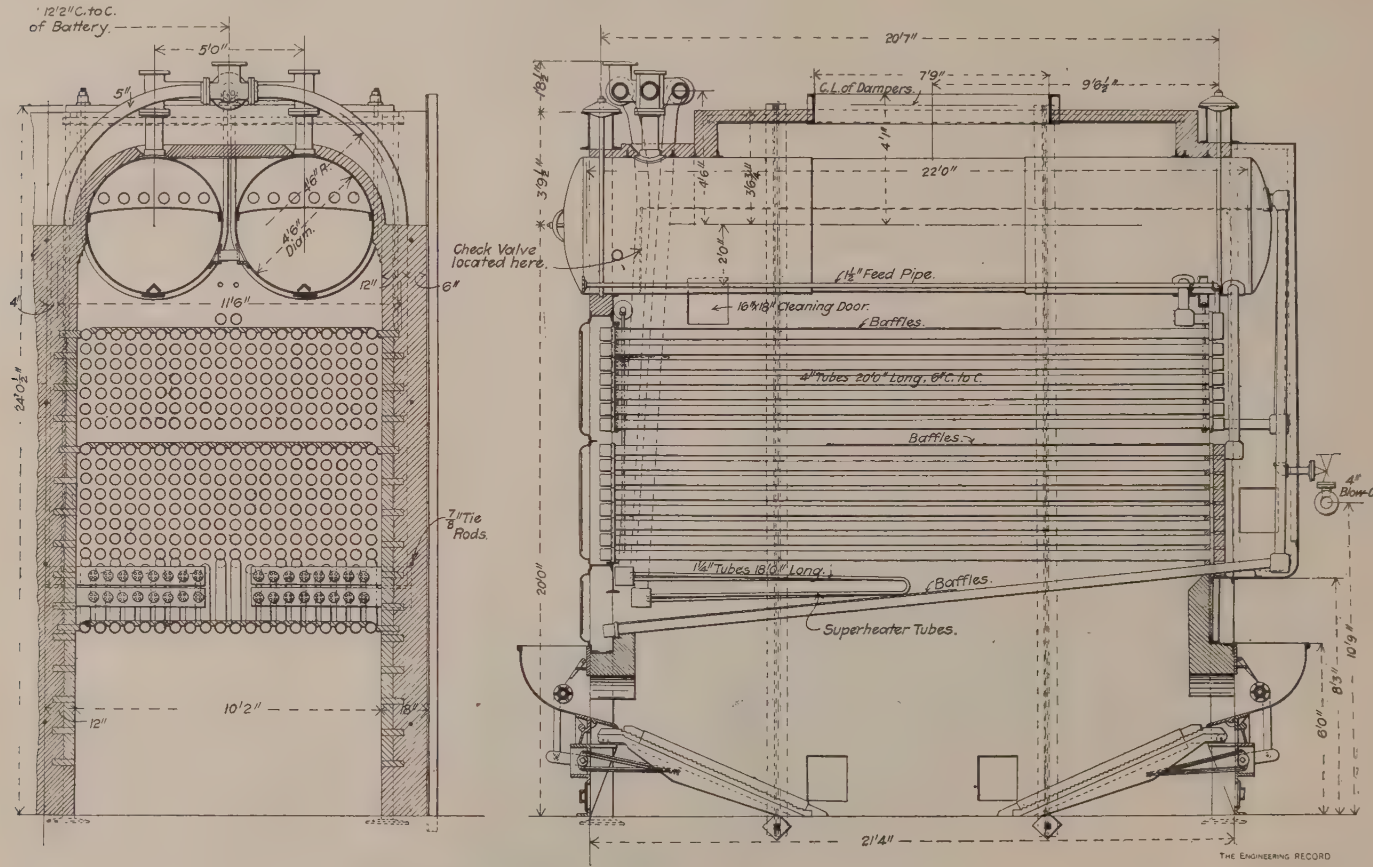
The Erection of a Large Gasometer.

A very large gasometer in Milwaukee has 26 tall vertical posts built in several stories and braced together by horizontal struts and X braces, as shown in the illustration. The solid-web posts have I-shaped cross sections and riveted connections and are the heaviest members in the framework. They are swung to position and assembled by a special revolving steel derrick of very large dimensions and unusual pattern which travels around the inner circumference of the gasometer and commands all portions of the steelwork.

The derrick has a pair of tall, light shear legs 145 ft. high which are hinged at the base to the outer end of a horizontal radial arm supported at the opposite end on a tower to which it is pivoted in the center of the tank and 70 ft. above its bottom. The shear legs are of rectangular cross section, made with four corner angles, latticed on all sides, and are tapered from the middle to both ends. They are X braced by tension rods in several panels formed by horizontal struts and are maintained at a slight angle from the perpendicular by steel cables from the head to the pivot. This angle may be varied tto adjust the inclination, but the legs do not act ordinarily as shears, but serve rather for the support and mast of a wooden boom seated on a cross beam near their upper end. The derrick has a capacity of 15 tons in the main falls and is moved on its circular track by electric or compressed air motors. The Riter-Conley Manufacturing Co., Pittsburg, is the contractor for the construction and erection of the gasometer.

Test of Parker Water-Tube Boilers.

The Second St. and Wyoming Ave. power station of the Philadelphia Rapid Transit Co. has recently been equipped with eight 700-hp. double-end-fired, water-tube boilers in which the water circulation is in the opposite direction to the motion of the furnace gases. A 400-h.p. inclined water-tube boiler of the ordinary type in the company's Thirteenth and Mt. Vernon Sts. station was converted into a reverse-flow boiler in 1902, and after a year's service test of that boiler, two 600-h.p. ordinary water-tube boilers in another of the company's stations were converted into reverse-flow boilers. Since that time other boilers of this type have been installed by this company and its Second St. and Wyoming Ave. station will contain 10,400 h.p. of them when the improvements to it have been completed. The double-end-fired boilers were adopted by the company in order to confine the boiler rooms to one level and to reduce the total plant space. This method of firing, combined with the reverse-flow type of boilers, reduced the total space occupied by the boiler-room about 40 per cent., as compared with single-end-fired boilers of the ordinary water-tube type.



Transverse and Longitudinal Sectional Elevations Showing General Arrangement of Parker Boilers.

The equipment of the plant will consist of six 1,500-kw. Westinghouse-Parsons turbine generator units, two Wetherill Corliss engines direct-connected to 1,000-kw. General Electric generators, two 500-kw. generator units, three 75-kw., 125-volt exciter units, direct connected to De Laval turbines, a 100-kw. exciter unit driven by a Reeves high-speed engine, and a number of auxiliaries. This equipment is all operated on superheated steam from reverse-flow water-tube boilers.

The general design of the boilers is to induce a constant flow opposite in direction to the flow of the furnace gases and to oppose the coolest parts of the boilers to the coolest part of the gases and vice versa. The 700-h.p. boilers each have two 4½ x 22 ft. combined water and steam top drums and 320 horizontal 4-in. tubes, spaced 6 in. on centers in horizontal and vertical rows under the steam drums. The general arrangement of the boilers is shown in an accompanying cross-sectional elevation. The steam and water drum is divided horizontally by a longitudinal steel diaphragm. The water tubes are separated in two sections, one above the other; the upper section contains 140 tubes in seven horizontal rows and the lower section contains 180 tubes in one inclined and eight horizontal rows. The tubes in the top tier of this section are connected with the back end of the part of the elevated drum below the diaphragm and at the bottom with an upcast which discharges into the elevated drum above the diaphragm. The tubes in the lower section have no feed water connection, but the upper row of tubes in it is connected with the rear of the elevated drums near the connections of the tubes in the upper sections; the lower row of tubes is connected with upcasts at the rear which discharge into the upper part of the drums.

The operation of the boiler is divided in heating the feed water, converting the heated water into steam and superheating the steam. The feed water is introduced into the top row of tubes beyond a check valve at the rear which prevents a backward flow into the steam and water drums. It passes downward through the tubes in the upper section and is discharged through the upcasts at the rear into the upper part of the drums. When feed water is not being supplied, water flows from the lower part of the drums through the upper section and back into the drums again, above the diaphragm. The tubes in the lower section are always supplied with heated water through connections between the top row of the tubes and the drums. The circulation in this section is also downward, from row to row, and in the contrary direction to the motion of the furnaces gases. The water passes into steam as it reaches the lower rows of tubes and the steam is discharged through risers at the rear into the drums above.

The upper section of tubes is divided in two separate elements and the lower section in ten elements, with a check valve in each element preventing reverse flow. The portion of each steam drum below the diaphragm is separated from the upper part at the front of the drum by a vertical diaphragm containing a check valve which permits steam and water to pass from the upper to the lower part of the drum, but prevents a reverse flow. The tubes are expanded into circular malleable iron junction boxes and each tube is provided with a hand hole in the junction box, the hand holes being closed by circular covers held in place by internal pressure.

The steam supply main is taken from the steam drums through a header in the top at the front. The steam passes down through the superheater and back up to the supply main. The superheater consists of 1¼-in., U-shaped tubes placed horizontally between the two bottom rows as shown in the accompanying illustration. Baffle tile carried on the bottom tubes can be arranged so any degree of superheat may be produced as the superheater tubes are directly over the stokers. Similar baffles laid on the boiler tubes distribute and direct the passage of gases from the furnaces to the flues.

A 24-hour test was made on one of the 700-h.p. boilers before the station building was completed, more to determine the greatest amount of power it could develop than its economy of operation. The results of this test are given in the table. The general uncompleted condition of the plant was against economical results, owing chiefly to the low temperature in the boiler room. The boiler was operated with natural draft. The boiler horse-power per square foot of space occupied by the boiler includes the stokers, feed-water heaters and superheater.

The adoption of the double-end-firing type did not necessitate any increase in the space at the rear end of the boilers over what was required for the flue with the single-end-fired boilers as the flues were placed on top of the boilers and the brick work around the headers and upcasts removed and replaced with a steel casing. The boilers have been in operation 6 months, and during that time no difficulty has been experienced with scale, as the upcasts from the tube sections discharge on the diaphragm such scale as forms in the tubes, the scale cracking off the tubes as rapidly as it forms. A soot blowing device, consisting of a cross header with a series of depending pipes supplying steam to all the spaces between the tubes, is placed just back of the front headers and soot may be blown from all the tubes by opening a single valve controlled from in front of the boilers.

Results of Test of Double-End-Fired Parker Boiler.

Heating surface in upper or feed water tubes, sq. ft.	2,972
Heating surface of lower section of tubes, sq. ft.	3,884
Heating surface of drums, sq. ft.	316
Total evaporating surface, sq. ft.	4,200
Heating surface of superheater, sq. ft.	377
Grate surface, sq. ft.	147.4
Kind of Fuel.—No. 1 anthracite buckwheat, b.t.u., per lb. of dry coal by calorimeter	12,708
Duration of test, in hours	24
Corrected gauge pressure at boiler, lb.	141.22
Draft in flue, inches of water	1.22
Temperature of superheated steam, corrected, Fahr	520.35
Degrees of superheat, Fahr	159.1
Temperature of feed water, average, deg.	35
Temperature of flue gases, average, deg.	419.9
Water evaporated from and at 212° Fahr., per lb. of combustible	11.18
Horse-power (34.5 lb. of water from and at 212° Fahr. per hour)	939.3
Rated horse-power	700
Square feet of boiler room per horse-power	.92
Horse-power per sq. ft. of actual space occupied by boiler	3.46

The boilers were designed and installed by the Parker Boiler Co., of Philadelphia.

In the Ingersoll-Sergeant Shops at Phillipsburg, which were described in this journal on April 15 and 22, mention was made of the special forms of roofing employed. It should have been added that the American Concrete Steel Co., of Newark, N. J., supplied the roofs for the foundry, office, compressor erecting building, power and boiler houses, smithy, oil-treating and drill-testing departments, and oil house. The Metropolitan Fire Proofing Co., of New York, furnished the roofing for the casting cleaning shed, compressor machine shops, warehouse and drill department. All these roofs were covered with tar and gravel supplied by the New Jersey Roofing & Construction Co.

The Double-Track Austerlitz Bridge, Paris.

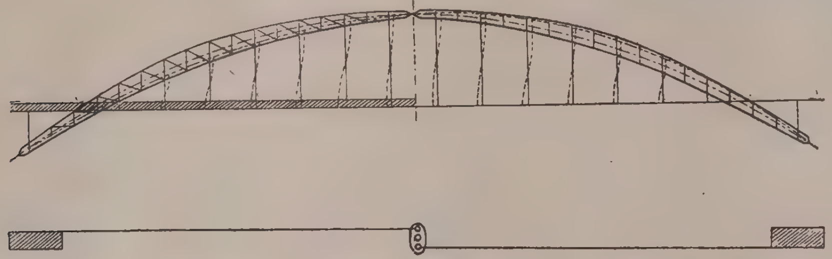
The Metropolitan Railway of Paris crosses the Seine on an arch bridge of 459⅓ ft. span with a suspended floor of peculiar construction. The arch trusses are made as shown in the general elevation, with four sections having fixed bearings on the abutments and hinged connections at the spandrels and crown. This substantially makes a three-hinge arch supported on long skewback girders, the upper ends of which are at approximately the same level as the floor platform. The floor is peculiar in that it is independent of the arch trusses except for its supports from them and that it is automatically adjusted to always maintain a symmetrical position in relation to the trusses notwithstanding the distortions which the latter may experience. The floor platform is designed as a horizontal girder carrying the wind stresses to the abutments and free to move longitudinally without transverse displacement. These unusual features have developed interesting analysis and details recently published in the "Genie Civil," from which data this description is prepared.

The principal requirements for the design were a clear span of 459⅓ ft. across the full width of the Seine and a three-hinge arch with a rise of 30½ ft. and a clear height of 36 ft. from the water level to the floor platform, the latter intersecting the arch trusses 22.3 ft. above the skewback hinges. The principal features of the design were intended to keep the structure as low as possible and provide headway for navigation, to conform with the existing bridges in the vicinity and to present a graceful appearance. This bridge is also notable for having the longest span of any in Paris.

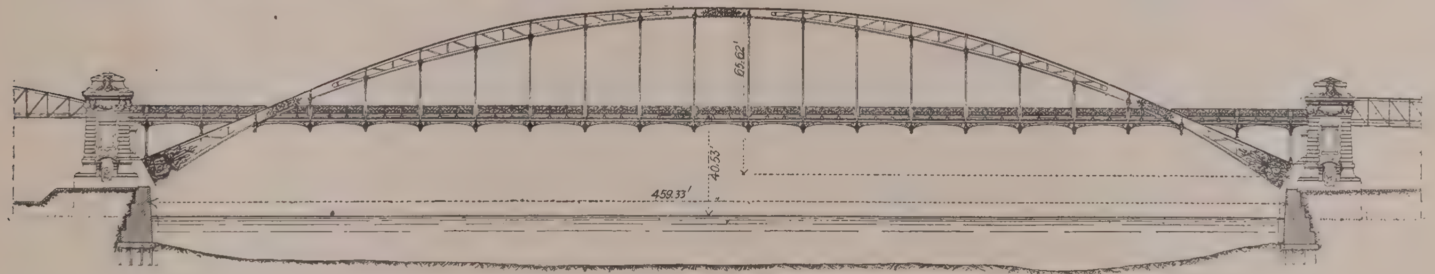
The relative position of the floor platform and arch trusses involved some difficulties in construction, of which the first was the impossibility of continuous transverse bracing between the trusses throughout their full length. It was obviously necessary to omit lateral braces for a short distance above the intersections with the roadway at both ends so as to allow clearance for the trains. This omission makes it impossible for the arch trusses themselves to transmit the lateral stresses from the crown to the abutments, and these stresses between the ends of the skewback girders have to be carried by the floor platform. In order to transfer the stresses from the arch trusses to the floor, the transverse bents at panel points must be capable of resisting the action of the wind, and this quality can only be obtained by making the vertical suspenders very wide in the direction transverse to the bridge axis, and making deep arch trusses and transverse braces.

Another difficulty was due to the fact that the floor platform could only be rigidly connected to the arch trusses at the points of intersection at one end, since if it were thus connected at both ends it would become a tension member producing considerable flexure in the trusses under the temperature deformations. If the floor platform is connected to the arch trusses at one end only, as, for example, at the right in the diagram, and is free to move longitudinally at the opposite end, it will not create stresses in the arch trusses, but when the arch is deformed by means of an unsymmetrical load, as, for example, one reaching from the free end of the floor to the center of the span, the upper ends of the vertical suspenders will be displaced horizontally toward the right, as indicated in the diagram. At the same time, the floor platform moving toward the left with temperature expansion will displace the foot of the verticals to the left, thus producing double flexure in the verticals, which is a maximum for the very short ones at the left end of the bridge.

These displacements are minimized by the use of the floor system adopted in 1897 by the Le Valloise-Perret Construction Co. for the Passy bridge, where it has given good satisfaction. This consists in making the floor platform move to correspond with the movement of the arch trusses and always maintain a center point in the same vertical plane with that of the arches, thus eliminating the displacement due to expansion and contraction. This result is secured by riveting the center of the floor platform to a short vertical having the extremities attached to tension rods reaching to both ends of the arch trusses, so as always to be in equilibrium and to carry the central point back and forth with the movement of the trusses. With this arrangement the computations show that the working stresses in the vertical suspenders are within the limits of elasticity of the material, except for the shortest members, where the flexure is eliminated by providing hinged instead of fixed connections at the top and bottom.



Longitudinal Displacements and Automatic Compensation.



General Elevation of the Austerlitz Bridge.

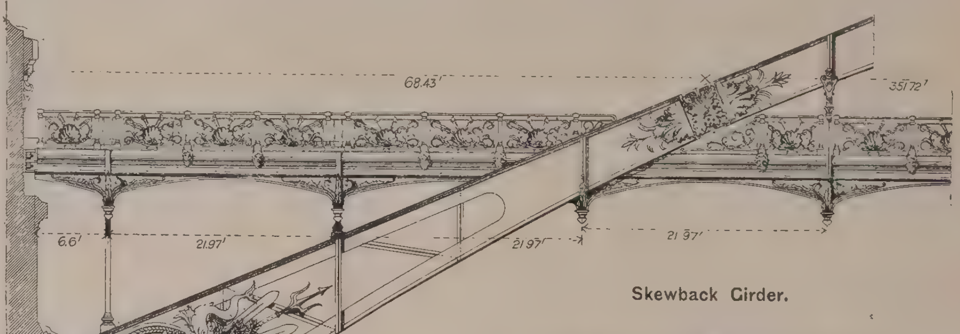
These trusses compare with ordinary hinged or hingeless arches very much as the cantilever compares with a through girder or a continuous girder. It creates fixed ends at the supports. The use of the hingeless arch with fixed ends is being more and more abandoned, partly because of the indeterminate stresses which vary with the least settlement of the supports and partly because of the considerable stresses developed by temperature variations. Arches with hinges at the spandrels are on the contrary free from these objections. All their stresses can be statically determined and temperature variations do not influence them. In this bridge the skewback girders are integral with the floor platform and are rigidly fixed on the abutments, thus reducing the arch span proper from 459⅓ ft. to 351¾ ft. The use of the third hinge at the crown considerably reduces the depth of the arch trusses and gives a lighter appearance to the construction. The center of the floor platform is maintained in position by the automatic tension rods already mentioned which are calculated to resist the action of trains and maintain the floor symmetrical with the transverse axis of the bridge. The wind pressures are directly resisted by the transverse strength of the vertical suspenders, which are made very narrow in the direction of the longitudinal axis of the bridge so as to offer the minimum resistance to longitudinal flexure. These members transmit the wind stresses to the floor platform, which is covered with flat steel plates and acts as a horizontal-web plate girder transmitting the transverse stresses to the skewback girders and to the abutments. The outside stringers form the flanges of this horizontal girder and are made from pairs of built channels. They have sufficient compressive and tensile strength, but conform readily to the deflections of the arch trusses and have a hinged joint in the center of the span. At the abutments and at their intersections with the arch trusses they have cast-steel bearings in longitudinal grooves which permit them to move back and forth without transverse displacement.

In the center panel the roadway stringers are hinged and the floor platform has an expansion joint to provide for the displacement of the points of support. In all other panels the distortion from flexure is negligible and the rigidity of the arch trusses prevents deformation and the stringers are attached to it with rigid connections.

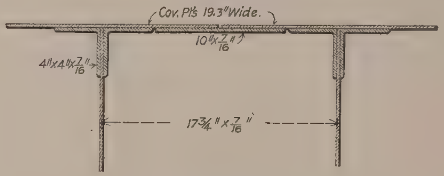
The bridge has been designed for the maximum unit stresses allowed by the government regulations of August 29, 1891, and provide for a wind pressure of 54 lb. per sq. ft. on the unloaded structure and 34 lb. on the loaded structure. Calculations have been made for a train load and locomotive excess in every position for each track and an allowance for brake stress has been made of 74,957 lb., assuming a coefficient of friction of 0.25.

Each arch truss is made in four sections, with top and bottom chords and vertical and diagonal members in the intermediate panels, and solid web plates at the end panels, where steel castings are provided for the hinge connections. The top and bottom chords have trough-shaped cross-sections of uniform dimensions except when the thickness of the web varies with the stresses. They are built up with plates and angles, and are somewhat peculiar from the fact that each web with its flange angles and coverplate has a separate T-shaped cross section, and the two are united by a center coverplate splicing the adjacent edges of the coverplates on each side, as indicated in the diagram.

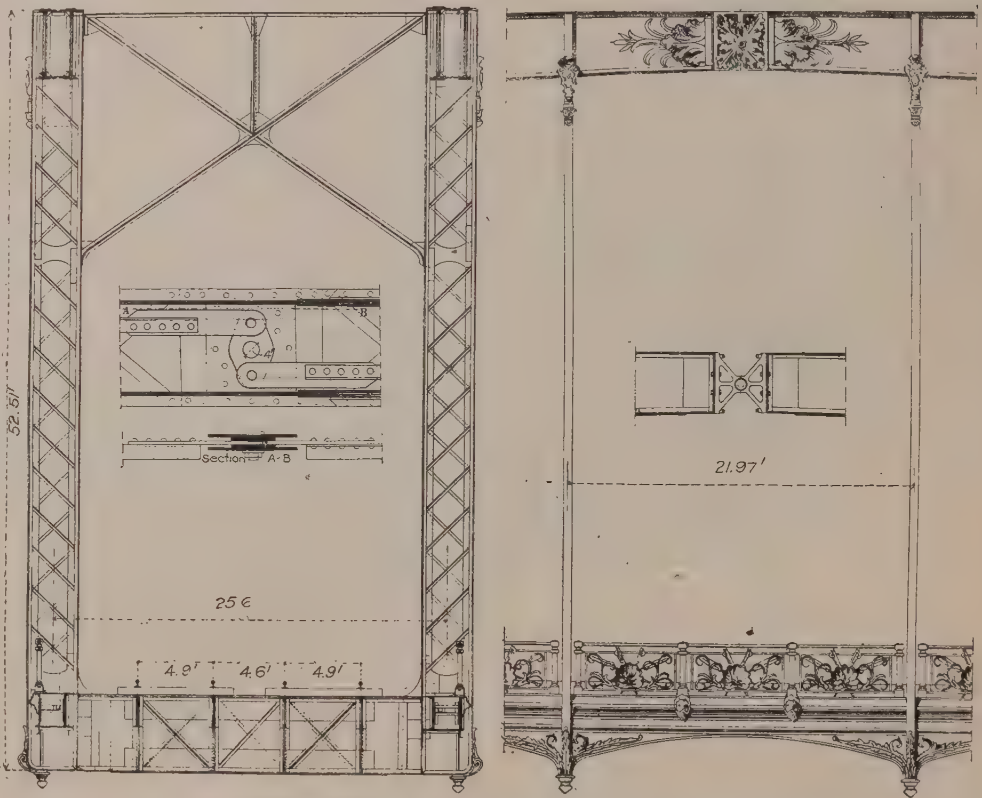
The skewback girders are supported on the abutments by cast-steel pedestals 5.9 ft. apart at the upper and lower ends of the base, where they are provided with adjustment keys. The pedestals have bearing surfaces 53 x 43 in. and 43 x 43 in. respectively. They are bedded on the masonry, with cement concrete poured in after they were correctly set in position. The vertical and diagonal members of the arch trusses are made with latticed angles. The trusses are braced together at portal points by light transverse lattice-girder struts with horizontal top flanges and curved bottom flanges, the latter being riveted tangent to the verticals just above their pin connections to the suspenders. Between the portals the trusses are braced by horizontal and diagonal angles riveted together at intersections so as to form light trusses affording swaybracing. These are made with pairs of angles, as indicated in the cross-section, and between them the top chords of the trusses are X-braced with pairs of members supported at their intersections by a longitudinal lattice girder carried at the center points of the transverse struts. Below the floor platform the skewback girders are braced together by three vertical panels of transverse struts and X-bracing.



Skewback Girder.



Top Chord Section.



Center Panel of Arch Truss of Austerlitz Bridge.

The floor platform is suspended from the arch trusses by vertical members with I-shaped cross-sections made with two T-shaped flanges latticed together in the plane transverse to the bridge axis. Their depth in this direction is 39 in., and the width in the opposite direction is 5.4 in., thus making them very flexible longitudinally to allow for temperature movements and having a large amount of resistance against transverse displacement so as to serve for swaybracing. Each flange is composed of two angles and a web plate which projects beyond their inner flanges to receive the lattice bars. In the shortest verticals the web plate is omitted and the lattice bars are riveted directly to the flange angles.

The vertical posts which support the floor platform from the skewback girders are, like the suspension members, 22 ft. apart in the clear and have cross-sections 58 in. wide and 8 in. deep, which differ from the former only in the size of the flange web plates, which are 17½ in. wide, and in the 8 in. coverplates on the angles. The four lines of plate girder stringers are in the planes of the rails and are made with 23½ x ¼ in. web and a pair of 3 x 3 x 5/16 in. flange angles. The fascia girders, which also act as chords for the horizontal wind pressure, have the same depth as stringers, so that their upper and lower flanges may receive the floor plates and lateral braces in the same plane. Each of them is made with two built channels having three thicknesses of plates in the webs. They are riveted through angles to the foot of the suspension members and the shore ends have sliding connections with the skewback girders to permit temperature movements. The lateral stresses are provided for by X-bracing in the floor platform, which has sliding points in the end panels to provide for expansion and contraction. The maximum deflections under live load are calculated to be 2.16 in. at the haunches and 1.45 in. in the center of the bridge. The rise and fall at the crown due to variations of temperature is 4.71 in. The main span weighs 700 tons, which includes 45 tons of steel castings and 5 tons of steel forgings. There are also about 160 tons of hand rail and decorative work.

The 59 x 72 ft. masonry abutments have pneumatic caisson foundations sunk to a maximum depth of 57.26 ft., for which a pit was dredged to a depth of 13 ft., and the caissons were sunk through sand and disintegrated limestone by a total amount of masonry in each abutment is about maximum of 5,886 cu. yd. of concrete in the steel coffer dams above the working chambers. The 7,848 cu. yd., which has an assumed weight of 13,800 tons and is employed to resist the arch thrust.

The superstructure was erected from a false work platform carried on wooden trusses supported by pile piers between which there were four openings 59 ft. wide in the clear for navigation, besides similar spans at the ends. The steel work was delivered at low level at the Austerlitz dock and hoisted by a hand derrick to cars which distributed it in position. Up to and including the floor platform the bridge was erected by a traveling gantry crane spanning the full width of the structure. Above the floor platform the erection was accomplished by a tower traveler surmounted by a turn-table steam derrick. The total cost of the bridge was about $290,000, $200,000 being for the substructure. The work was executed under the direction of M. Bienvenué, chief engineer of the Metropolitan R. R., M. Biette, joint chief engineer; M. Briotet, division engineer, and M. Faillie, section engineer.

Smoke Prevention and Mechanical Stokers.

The amount of damage done in cities by the smoke from soft coal must be very large, although it is difficult to estimate with any approach to accuracy. The deterioration of dry goods, books, paintings and furniture by the smut in the air of Pittsburg or Cleveland is too serious to be borne much longer by the inhabitants. This smoke can be greatly reduced by attention to the firing. For some time Prof. Chas. H. Benjamin has been making a study of the methods of accomplishing this end and at the recent convention of the American Society of Mechanical Engineers read a paper on the subject, from which the following notes have been abridged:

The best solution of the smoke problem, so far, in his opinion, has come from the introduction of mechanical means of handling the coal, which give a uniform feed to the fuel and a corresponding delivery of air combustion.

The use of mechanical stokers has been brought about by the natural demand for machine handling in large power plants as more economical than human labor, rather than by a philanthropic desire to benefit the community.

The inclined grate, as exemplified in the Wilkinson, Brightman and Roney stokers, has a hopper in front and slopes down and back, having a clinker grate just in front of the bridge wall, while the double incline, as in the Murphy and Detroit stokers, has a magazine on either side and slopes in two planes parallel to the axis of the boiler, meeting in a clinker grate at the bottom. The principle of action is practically the same and involves the slow coking of the coal on a dead-plate, the pushing forward on to the top of the incline and the gradual descent, impelled by oscillation of the grate bars, until the combustion has left nothing but ash and clinker at the bottom. Air is usually admitted both below and above the grate, and the hydrocarbons which are distilled at the top of the grates pass through the intense heat of the burning coke on their way to the bridge wall and are completely burned. The double incline usually has a revolving clinker bar which disposes of some of the ash automatically, but as a rule both forms need considerable cleaning.

When used with a fuel which does not cake or clinker too much and when not crowded too hard these stokers are economical and reduce the smoke considerably.

If, however, it becomes necessary to slice and poke the fire on account of caking coal or overcrowded boilers, unburned masses of coal are rolled to the bottom and holes are made in the fire through which cold air rushes. Both of these circumstances make for poor combustion and a smoky fire. As a rule firemen poke the fire on stokers too much, doing more harm than good.

The traveling or chain grate is rapidly coming into favor as a means of stoking automatically. It consists, as in the Babcock & Wilcox and Green stokers, of an endless horizontal chain running on sprocket wheels and carrying the coal back under the boiler, finally dumping the refuse over the back and into the ashpit. The distilling process and the gradual burning of the coke are much the same as in the stokers just described. In order to prevent waste through the grates the latter are usually quite close, and it becomes necessary to use more draft than with ordinary grates.

A damper is used underneath the grate to prevent an excess of air from passing up behind the grate. Some tests recently made by a large corporation which uses a considerable number of the chain grates showed an evaporation of only 5.7 lb. of water per pound of coal. An examination disclosed the fact that a large excess of air was passing through the comparatively bare grate at the rear end. The introduction of a damper to regulate this brought about a great improvement. With the same fuel and same conditions as before an evaporation of 8 lb. of water per pound of coal was obtained. From observations covering a period of several years Prof. Benjamin has come to the conclusion that this type of grate is the best one yet devised for abating smoke. The fact that it is horizontal, so that unburned coal cannot run to the rear end, and the further fact that it is self-cleaning and need not be disturbed by the slice-bar, make it an almost ideal furnace in this respect.

The underfeed stokers operate on an entirely different principle, the coal being fed in underneath the grate and forced up through a rectangular opening in the center. A forced blast is used and the air for combustion is blown up through the coal, the tuyeres being on either side of the rectangular opening just mentioned. By this arrangement the fresh coal is always underneath and the distilled gases are obliged to pass through an incandescent mass of fuel in company with the air. With a proper pressure of blast perfect combustion is thus almost unavoidable. The ash and clinker are now at the top of the fuel, which forms a gradually rising mound in the center and pushes the clinker over to either side, whence it is removed by hooks through doors at the front. The heat generated is such that the ash generally melts and forms a sheet of clinker which can be easily removed without disturbing the fire. In the American stoker the coal is forced under the grate and up by a revolving screw. somewhat similar in shape to the ordinary gimlet pointed lag screw. In the Jones underfed stoker a plunger driven by steam operates to feed the coal. This plunger can be arranged to start and stop by hand or to run automatically. Prof. Benjamin's experience has shown the underfeed stoker to be economical in operation and practically smokeless.

With the complaint sometimes made that stokers cannot be forced, Prof. Benjamin has no sympathy. With an ordinary inclined grate stoker under a horizontal tubular boiler he has forced a boiler to 75 per cent. above its rating with practically no smoke and with an evaporation of over 8 lb. of water per pound of bituminous slack. It all depends upon the draft and upon the intelligence of the fireman who operates the stoker.

It must be remembered that a smokeless chimney does not always mean good economy. An excess of air may insure entire oxidation of the combustible matter, and at the same time so dilute the chimney gases as to cause serious waste of heat. The problem to be studied by the manufacturer should be how to obtain the most perfect combustion of the particular fuel which he uses and then the smoke question will take care of itself. Let him make frequent analyses of chimney gases, compare different pressures of draft and different dispositions of dampers and he will be repaid for his trouble in more ways than one.

Whenever for any sufficient reason the stoker cannot be introduced. there are other devices which will mitigate the smoke nuisance considerably and also save fuel. The steam and air blast has already been mentioned. A recent improvement which promises well is the combination of steam jets at the bridge wall with oil vapor, creating an intense heat at that point and consuming the hydrocarbons as they pass through. The expenditure of oil is comparatively small and considerable economy is said to result.

Brick arches and baffle walls have also assisted in maintaining a high temperature and in properly mixing the gases. The use of a reverberatory furnace or outside oven in which the coal and its gases are thoroughly burned before going to the boiler is another satisfactory method of reducing smoke, and may be used as well with as without a stoker.

In short, whatever produces good combustion abates smoke. In apartment houses and stores where the boilers are used for heating only and the steam pressure is low, the use of fuels which are comparatively smokeless is about the only satisfactory solution.

Book Notes.

Something like a year or so ago the U. S. Geological Survey undertook the compilation of deep-well data, and the first number of its annual report of such work, covering the notes secured last year, has just appeared. They cover oil, gas and water wells, and give considerable information concerning the cost of sinking a well as the strata penetrated and other geological data.

The latest bulletin of the Columbia University Fire Testing Station is a report of a fire and water test on truss metal lath partitions, conducted by Prof. Ira H. Woolson, under the supervision of Inspector Schwartz, of the Manhattan Bureau of Buildings. The methods and results of the experiments are described and the text of the official approvals of the construction by the superintendents of buildings of Manhattan and the Bronx. (Columbia Univ. Fire Station, paper, 25 cents.)

Somebody had the nerve to ask the Department of Commerce and Labor to secure from the American consular officers abroad reports on municipal ownership, and it has accordingly prepared a pamphlet covering all the information collected in 1897-1905. It is a very interesting work, particularly those portions of the older reports telling what was proposed when they were written, and similar portions of recent reports showing how much of the anticipated progress has been made. Most of the data relate to street railways.

The third annual issue of the "Jahrbuch für das Eisenhüttenwesen" is a volume of 480 pages in which is summarized the cream of the articles published during 1902 in 134 journals, of which 57 were in German, 40 in English, 19 in French and the others in six other languages. These summaries are classified under fuel, boilers, fire-resisting materials, slag, ores, plants, blast furnaces, foundries, wrought iron, steel, steel mills, special processes, properties of iron, alloys and combinations, tests and general subjects. The work is done with characteristic German thoroughness. (Düsseldorf, A. Bagel.)

Now that copper stocks are attracting so much attention, a pamphlet by Mr. Arthur L. Carnahan on the "Development of the Lake Superior Copper Mines" is particularly timely. The author has charge of the mining news in the Houghton, Mich., "Daily Mining Gazette," and enjoys exceptional opportunities for securing reliable data at first hand. The pamphlet gives a review of all the copper mining in this territory in 1904, describing the equipment and the underground workings. It is sold by the author at 50 cents.

Prof. R. J. Woods has published in his "Strength and Elasticity of Structural Members," a revised form of his lectures before the students at the Royal Indian Engineering College, at Cooper's Hall. These cover the elements of graphic statics, stress and strain, bending moments and shearing forces, moments of inertia, girders, deflections, masonry structures, columns, riveting, continuous girders, cantilevers, arches, suspension bridges and torsion. The most characteristic feature of the book is the provision of many well-selected examples for the student to work out. (New York, Longmans, Green & Co.; cloth, 8vo, 322 pp.).

The Bureau of Insular Affairs of the War Department has issued the official report of the Philippine Exposition Board for the Louisiana Purchase Exposition. This Board had the most costly and extensive exhibit at the fair. It was the result of the hard work of a representative American and Philippine organization working under the incentive of an urgent request from President Roosevelt to have the display of the maximum educational value. Those who examined the exhibits do not need to be told that this request was well answered; those who did not have this opportunity will find in this well-illustrated book a great deal of interesting data concerning the islands and their people.

In a monograph on the removal of iron from ground-water, "Enteisenung von Grundwasser," Dr. L. Darapsky first reviews the general progress of the art and then explains some experiments of his own. The latter were intended to make clear the effect of measured quantities of air on iron-carrying water. He explains his methods of analysis, the character of the water, the experimental apparatus and its use. His experiments showed that the periods of time necessary to effect the same separation of iron were inversely proportional to the amounts of air employed in aerating the water, and from this result he suggests a method of iron removal of a novel nature. (Leipsic, F. Leineweber; paper, 12mo., 104 pp.).

Many of the readers of this journal will find Mr. A. W. Farnsworth's "Constructional Steelwork" a work of more than ordinary interest. It is a discussion of British equipment and organization for manufacturing steel work. The author first explains what he calls ideal designing, by which he means designing which is based on a knowledge of shop conditions as well as stresses and the strength of materials. The ways of securing economy are pointed out, the duty of the designer is explained, and there are chapters on tests and analyses, specifications, drawings, inspection and estimating, all taken up from the point of view of a shop manager who wishes to turn out good work without unnecessary expense. The second portion of the volume describes the British system of shop work, taking up in succession office routine, the template shop, the girder shop, the smithy, finishing and shipping methods, and general equipment. The book is practically sui generis; with the exception of Mr. Molesworth's paper before the Institution of Civil Engineers and the descriptions of bridge shops in this journal, there is little else in English on its subject. (Philadelphia, J. B. Lippincott Co.; cloth, 8vo, 264 pp.)

The Mississippi floods have such an important commercial result that from the time of the Humphreys and Abbott investigation to the present time they have received a great amount of attention from engineers. The latest monograph on the subject is the interesting report on the "High Water of 1903," by Chief Engineer T. G. Dabney of the Yazoo Mississippi Delta Levee District, of Clarksdale, Miss. This flood was, of course, not so serious as that of 1897, but in the lower basin of the river, as at Memphis, the maximum stage in 1903 was higher than in 1897. The course of the flood is described at length, and some valuable information is given concerning its effect on the levees. The foundations of such structures are stated to offer serious problems, which are increased by the practice of opening burrow pits just behind them, while the damage to the face of the levees by the wash of waves makes some inexpensive protection highly desirable.

Letters to the Editor.

CEMENT BRIQUETTES.

Sir: The shape of the standard briquette used in testing cement has always been a source of wonder to me, possibly through my ignorance of some of the inherent properties of the material.

We all know the unsatisfactory results that were obtained, in times past, from steel test bars, where a short neck in the specimen was made. It can, of course, be argued that steel tends to flow under tension, and that this short neck concentrated all of the flowing action within small limits, while concrete does not exhibit this phenomenon. Still, is it not within the bounds of reason to assume, that this same short neck on the cement specimen, limits the range of action to such an extent, that cross stresses are set up and consequently the apparent elasticity is much less than the real elasticity?

May not this fact explain, in part, the reason why concrete beams reinforced with steel will stand so such more stretching?. I say in part, for I can readily see that the imbedded steel will distribute the elongation over the whole length so long as the elastic limit is not exceeded.

It seems that this subject is worthy of at least a passing thought by those who are giving so much attention to the whole subject of cement in structural work.

Yours truly, R. M. BROWN.
Chicago, June 14.

UMBRELLA TRAIN SHEDS.

Sir: I have noticed at various times that the railroad and other papers seem to approve of the umbrella sheds in lieu of train sheds, and cannot understand it, as they do not afford any protection to the traveling public in case of a heavy rain. The new style of umbrella sheds with the gutter in the center, which I saw one of the papers praise so highly the other day, is far worse than the old-fashioned umbrella shed.

The new style has been adopted by the Long Island Railroad for their Long Island City tracks, and it was a sight to see the passengers alighting from the trains Monday morning in the heavy rain, and how they walked in Indian file down that umbrella shed trying to find dry spots, without success! There was absolutely no protection, whatever, on this occasion.

Several railroads are seriously thinking of adopting the umbrella shed scheme, and I sincerely hope they will, for the sake of the traveling public, think of some other way of providing for the comfort of their patrons.

Yours respectfully, TRAVELER.
New York, June 14.

CALIFORNIA OIL ASPHALT.

Sir: With many others interested in good asphalt pavements, I have read Mr. Clifford Richardson's book upon that subject and also a recent review of the publication by Mr. S. Whinery. Through many pages and chapters devoted to soils, drainage, foundation, base, concrete, sands, cement, binder course, etc., Mr. Whinery follows the author with cordial approval. We are finally, however, pained by a discordant note. The pleasing harmony disappears. They agree about sands as if they had played together upon the same sand heap when they were boys, but when asphalt is reached, they stand like Jap and Russ with drawn swords in Manchuria. We awake to the fact that they contend for rival commercial interests. Mr. Cannon. upon being elected Speaker of the House of Representatives was congratulated by a group of Democrats. They ventured to express the hope that in partisan matters he would rule fairly. "Gentlemen," said he, "I propose to rule as fairly as the exigencies of American politics will permit." In discussing asphalt, Messrs. Richardson and Whinery seem to be as fair as their respective interests seem to permit, but not fairer. Mr. Richardson claims Trinidad asphalt to be best to produce successful pavements, while Mr. Whinery stoutly maintains it to be unsafe and objectionable.

In reference to another asphalt, that obtained from refining the asphaltic oils of California, their pleasing accord is again in evidence. They agree that the product of Trinidad Lake, a combination of asphaltic bitumen, earth, etc., should be called asphalt, while the California bitumen should be called "residual pitch." Both admit that it sometimes produces excellent pavements, but claim that it is a by-product, often carelessly refined and frequently subjected to excessively high temperatures in process of refining.

May I point out a few facts? (1) That every known asphalt is a product of asphaltic petroleum. (2) That in the asphalt deposits of Trinidad and Venezuela the lighter oils have evaporated under the rays of a tropical sun, while in California the same result is obtained by refining. (3) Both classes of products have to be refined, one to get rid of earthy matter and water, and with the other, to separate it from oils. (4) That carelessness in refining the California products is rare, the business success or failure of the refiners is at stake, and both Messrs. Richardson and Whinery are aware that no mined asphalt ever ran so chemically uniform as the product of the asphalt refineries of California. (5) That asphalt is one of the most important products of California petroleum, often amounting to from 25 to 60 per cent. of the whole, and some refineries produce nothing else. To call this a by or residual product is an absurd misuse of language. (6) After an examination of asphalt pavements in most important American cities, we are prepared to say that we have seen few defects where this asphalt has been used and no case where the failure was due to the material.

If excellent pavements are being laid by contractors with this material in every section of our country, in some cases without engineering assistance, what would the record have been if it could have had the advantage of such expert supervision as Messrs. Richardson and Whinery could have given?

CALIFORNIA ASPHALTUM SALES AGENCY.
New York, June 19.

CURRENT NEWS SUPPLEMENT

JUNE 24, 1905.

DIRECTORY OF NATIONAL TECHNICAL SOCIETIES.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th St., New York.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York.

Association of Engineering Societies. Secretary, W. H. Merrill, Jr., Chicago.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York. Annual meeting, Chicago, July 7 and 8.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St. Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo. Annual meeting, Atlantic City, N. J., June 28 and 29.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa. Annual meeting, Atlantic City, June 29-July 1.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y. Annual meeting, Sept. 5-9, Montreal.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

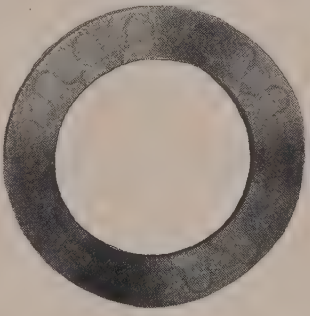
American Public Works Association. Secretary, W. H. Flint, Chattanooga. Annual meeting, Chattanooga, Aug. 30-31.

A NEW DESIGN OF MAGNETIC CLUTCH.

A new magnetic clutch recently placed on the market by the Cutler-Hammer Clutch Co., Milwaukee, is based on a dynamo-electrical principle which permits a wider range of usefulness than that of mere clutching. The device operates by an annular electro-magnet concentric with and revolving with the driving member in front of the driven member, consisting of a plain disk of iron, the armature or "keeper." The magnet is a circular coil enclosed in a groove between the two iron rings forming the driving member, the outside or driving-face ring, however, having a zig-zag groove cut entirely through it all the way around. This opening serves as the air-gap of the magnet and, when the magnet is completed, is filled with babbitt, as shown in one of the views. It is evident that a longitudinal section through the periphery of this magnet member would resemble in outline the ordinary horseshoe magnet. It is, however, the overlapping or interlocking of the pole projections of the two polar members that cause the desired magnetic drag effect in the armature or driven member.

This starting effect, or torque, is the sum of two components, one due to friction and the other due to eddy currents induced in the armature plate by the magnetic flux, which latter is carefully designed to secure this result. At the moment of starting the induction component of torque is a maximum, dropping off as the driven member attains speed. It will be remembered that in starting up a load with the ordinary frimtion clutch the pressure on the operating level is eased the moment the load begins to move in order to obtain a smooth start; in this system this is accomplished automatically by dropping off one component of the torque, the result being a remarkably smooth acceleration, which can be controlled, if desired, by means of a rheostat. The device operates equally well whether the shafts to be coupled are at rest or one is revolving at speed.

The small currents used in the magnetizing coil result in a simple controlling apparatus, two amperes being sufficient to control a 100-h.p. unit at the ordinary speed. One of these clutches now in operation in the steel plate mill of the Riter-Conley Mfg. Co., at Leetsdale, Pa., has been starting a 100-h.p. load 200 or more times a day for the past three months, without requiring any adjustment whatever, and is still operating as satisfactorily as when first installed. In connection with gear trains this device is also used to operate a machine at different speeds, and this arrangement has proven very satisfactory in practice.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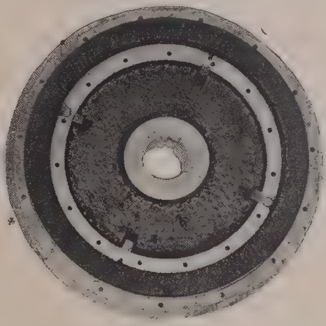
BACK PLATE WITH COIL.

RAILWAY CONSTRUCTION IN GUATEMALA.

A 65-mile extension to the Northern Railway of Guatemala is being constructed which will join that road with the Guatemala Central Railway and provide railroad connection across the country between the Atlantic and the Pacific. The Northern Railway was built from Puerto Barrios, on the Gulf of Honduras, on the Atlantic side, inland about 135 miles to El Rancho several years ago by the Guatemala government. The original intention was to complete the road to Guatemala, the capital of the country, but this was never carried out. The Guatemala Central Railway is built from San José, on the Pacific, to Guatemala. The Northern Railway was recently acquired by an American syndicate, which is entirely rebuilding it and constructing the extension.

The part of the road that was originally constructed is built up the valley of the Motaqua River, a tropical stream subject to heavy floods. The road has a 3-ft. gauge and was built with light rails, little ballast and mostly with timber bridges. Several years ago the principal bridge on the road over the Motaqua River was washed out, and since then the road has been operated in a desultory way in two sections, one over either side of this crossing, with a ferry connecting them. The maintenance of the road had been much neglected and the roadbed, track structures and buildings had greatly deteriorated. The old road is being entirely rebuilt. The 3-ft. gauge has been retained, but all the bridges are being built and the cuts and fills are being made so the track may be widened to standard gauge with little new construction.

The first 75 miles of the line is largely through dense tropical jungle and the old ties are being replaced with 6x8-in. by 8-ft. creosoted yellow-pine ties, imported from the United States and laid 2,464 to the mile. The remainder of the old line and the extension will be laid with plain yellow-pine ties, spaced the same as in the first 75 miles. The old rails will be replaced by 60-lb. rails and the entire road will be ballasted with broken stone. The old timber bridges on the line are being replaced by steel plate-girder bridges on masonry footings. There are to to be six 25 to 40-ft. girder spans, two 80-ft. spans and one 150-ft. bridge, all of which are designed to carry two 85-ton engines in tandem, followed by a uniform load of 3,000 lb. per foot.

The extension leaves the valley of the Motaqua River at El Rancho and proceeds across the country up a rapidly rising ascent to Guatemala, which is about 5,000 ft. above the sea. A number of sharp curves and heavy grades are required in making this ascent, but the road can be operated easily with ordinary steam locomotives. A large amount of earth, loose rock and rock excavation and a number of heavy fills, which are all being made wide enough for standard-gauge track, will have to be completed before the extension is finished.

A temporary steamship pier is constructed at Puerto Barrios and lines of steamships are in operation between that port and several American ports. The Guatemala Central Railway port at San José is connected with Pacific steamship lines, so the new road has connections with established steamship lines on both oceans. Several locomotives and a large number of freight cars are being purchased to operate the road, which has a traffic consisting at present principally of coffee, bananas and fruits. A wide variety of products may be grown easily in the country tributary to the road, which is built on the only practical route into the interior.

The road is being reconstructed and the extension built by the Guatemala Railway Co., of New York, which expects to have it in operation from Puerto Barrios to Guatemala by December.

TRADE PUBLICATIONS.

The Friestedt Interlocking Channel Bar Co., Inc., Tribune Building, Chicago, has issued a profusely illustrated catalogue of its steel piling and works constructed with it The patent claims are given in full and the discussion of the advantages of steel piling is thorough and fair. The illustrations show the use of this material in difficult foundation work for bridge piers, power houses, dams and warehouses, and give a good idea of some of the novel methods of design which interlocking channel bar piling has rendered practicable.

Automatic injectors, jet pumps and other steam specialties of the Pemberthy Injector Co., Detroit, Mich., are described in its new 1905 catalogue. Many classes of equipment are embraced besides injector apparatus, one of the most interesting being a new type of double automatic water gauge, consisting of double glasses, with automatic checks which is claimed to be better than a low-water alarm.

Supplementary catalogue 28, issued by John H. McGowan Co., Cincinnati, O., refers briefly to the McGowan line of duplex pumping machinery. Boiler feed and general service pumps of the packed piston type, pump governors, fire pumps, high pressure pumps, simple, compound and condensing, and power pumps are illustrated.

Catalogue 20, issued by Frank B. Gilbreth, 34 West 26th St., New York, is devoted to some interesting pictorial records of rapid construction, which is one of his specialties. To accomplish the results that stand to his credit in the way of shops, schools, houses, power plants and other structures it is necessary to have an unusual organization, and some notes concerning it are given in the pamphlet.

The Johns type of beam shears is described in catalogue 28, from Henry Pels & Co., 68 Broad St., New York. These are made in a great variety of sizes and forms, both stationary and portable, and the catalogue contains a novel table showing at a glance the range of capacities of each form. There are also some interesting diagrams showing how the shears cut different shapes.

The Crocker-Wheeler Co., Ampere, N. J., describes in bulletin 51 a line of small belted motors and generators, which represent fifteen years' special study of such apparatus. They are made in sizes of 3 to 9½-h.-p. capacity and the catalogue illustrates a wide variety of uses for them.

Recent publications received from the Westinghouse Electric & Mfg. Co., Pittsburg, Pa., include circular 1096, descriptive of the latest Westinghouse designs of oil switches and oil circuit breakers, with auxiliary apparatus for handling high-voltage currents; circular 1097, descriptive of the Westinghouse type K, direct-current, series-wound motors for crane and hoisting service, with their characteristic curves; circular 1099, on the new type-

R bipolar direct-current motors for small machinery driving, their power range covering from 1/6 to 1¾ h.p.; folder 4030 descriptive of the new type-S direct-current motor, particularly adapted to variable-speed machine-tool driving and illustrating many typical applications to machines; folder 4038 on type-F induction motors, with illustrations of applications to all classes of machinery driving; folder 4032, entitled "Wattmeters and How to Read Them," a popular treatment of the wattmeter, very attractively gotten up for distribution by lighting companies.

The American Well Works, Aurora, Ill., has issued a large catalogue of machinery for sinking and operating all kinds of wells. Several types of drilling machines and a wide range of pumps operated by steam or compressed air are shown, together with auxiliary tools and machines

The Greer Filter Co., Perry Bldg., Philadelphia, Pa., has issued a catalogue describing water softening apparatus of various types, which contains a number of views of such plants, with analyses showing the results obtained in each case. The same company has also issued an illustrated catalogue of the Greer system of mechanical water filtration which contains considerable information on that subject, particularly regarding plants using iron sulphate as a coagulant.

The Watertown automatic engine is referred to in a folder issued by the Watertown Steam Engine Co., Watertown, N. Y. Some of its advantages are explained and the range of sizes built at the works is outlined.

Elevated tanks, standpipes and equipment for water works for small towns are described in a well illustrated booklet sent out by the Des Moines Bridge & Iron Works, Des Moines, Ia. It contains a number of views of elevated water towers and other structural steelwork erected by the company.

The catalogue of the Concrete Building-Block Co., Newark, N. J., contains a number of illustrations of large structures recently built of hollow concrete blocks and also some interesting historical information on cement and concrete.

Many of the concrete bridges, arches and culverts that have been built according to the Luten system by the National Bridge Co., Indianapolis, Ind., are illustrated in the catalogue of that company; a two-page insert shows seventy of such structures that have recently been erected in the Central States.

A comparison of ammonia compressors for refrigerating plants is given in an illustrated pamphlet issued by the York Mfg. Co., York, Pa. Numerous illustrations are presented of compressor installations in ice plants that are in satisfactory operation.

The Westinghouse-Parsons steam turbine is interestingly treated in a pamphlet recently published by the Westinghouse Machine Co. The early development, constructional details, principles of operation and advantages are referred to in considerable detail. The book also gives the typical efficiency tests of the turbines under all conditions of operation.

The C. O. Bartlett & Snow Co., Cleveland, O., has published catalogues 15 and 10 for 1905, which cover the extensive line of engineers' and mill furnishings handled. The company manufactures machinery for oatmeal and breakfast-food mills, flour mills and grain elevators, fertilizer and Portland cement mills, all kinds of conveying machinery, derricks, hoists, quarry machinery, direct heat and steam dryers, etc., special attention being given to labor-saving machinery. Catalogue 10 is a special gear catalogue.

Pamphlet 25, from The W. J. Clark Co., Salem, O., explains the Lane patent joist or timber hanger for supporting floor joists. Numerous tables are presented showing the proper sizes of hangers for use under various conditions, the estimated safe loadings, weights, dimensions, etc. Other sheet steel specialties of the company are also referred to.

The details and method of operation of the Federal blue-printing machines are explained in full in a pamphlet issued by the Spaulding Print Paper Co., 44 Federal St., Boston, Mass. This machine is designed for the continuous production of blue prints by electric light.

The Hunt noiseless conveyor and other machinery for the handling of coal and ashes in power stations are described in catalogue 053 of the C. W. Hunt Co., New York. The characteristic features of the Hunt system are illustrated in detail and numerous views of adaptations to local conditions are presented, which indicate the specialty of this company in application of labor-saving handling machinery.

A large catalogue of conveying, elevating and power transmission machinery has been published by the Williamsport Clutch & Pulley Co., Williamsport, Pa. The line manufactured is very complete, the specialty of the company being, in fact, labor-saving machinery for all classes of industries.

The General Electric Co., Schenectady, N. Y., has issued the following bulletins: No. 4393, small moderate-speed engine-driven alternators with direct-connected exciters; 4394, the form-P belt-driven alternators built in six sizes from 30 to 200 kw. capacity; 4399, small direct-connected generating sets in various sizes from 2½ to 75 kw. capacity for marine purposes; 4398, the General Electric remote-control field rheostat for use with railway generators and rotary converters; 4401, the type-UP motor-starting rheostats with switches and fuses, for use with either shunt or compound motors.

Steel plate fans and blowing machinery accessories are described in catalogue 53 of the New York Blower Co., Chicago, Ill. Information regarding blowing apparatus is given and recent installations of the company are mentioned. Catalogue 55 is a brief treatise upon heating and ventilation, and describes the special blower and heater designs of the company for this purpose.

The leaky joint problem and a way to solve it is the subject of an interesting pamphlet issued by the Central Foundry Co., 116 Nassau St., New York. It describes the construction and use of the universal joint and gives views of lines of this type under construction.

Air compressors are discussed in a pamphlet made up of advance-sheets of catalogue 36 of the Ingersoll-Sergeant Drill Co., New York. Compressors for all classes of service are illustrated and much valuable information regarding them is published. Important improvements in the form of positively operated air valves have recently been incorporated in the Ingersoll-Sergeant compressors.

An instructive explanation of motor-driving equipments for printing presses and allied machinery is presented in bulletin 221 of the Sprague Electric Co., New York. This company has made a specialty of motor driving for this class of machinery and many installations are illustrated. The line of electrical apparatus for driving purposes and control is also well shown.

The generation of power by the suction gas producer and gas engine upon the Weber system is treated in detail in an interesting catalogue from the Weber Gas & Gasolene Engine Co., Kansas City. This company, in addition to building internal combustion engines in the vertical double and triple cylinder types, in capacities from 40 to 325 hp., is manufacturing a continuous-operation suction gas producer, which is particularly adapted for use in small power plants in connection with the gas engine. Valuable information is incorporated in connection with the installation and operation of this class of power apparatus. Charcoal is recommended for the producer fuel in districts removed from the coal regions and interesting information regarding charcoal burning is added in a special folder.

U. S. naval coaling stations are interestingly described in a profusely illustrated pamphlet from the Mead-Morrison Mfg. Co., successors to John A. Mead Mfg. Co., New York. Some of the many navy yard coaling plants installed for the U. S. Government are shown and their equipments explained. A special product of this company is their Rawson patent coal hoisting grabs.

Reynolds Corliss engines are listed in catalogue 120 of the Allis-Chalmers Co., Milwaukee, Wis. The line of Reynolds Corliss engines built to standard designs by the company include heavy duty and girder frame engines, vertical, horizontal-vertical and compound engines, blowing engines and reversible engines for rolling mills, and the Riedler air compressors. The pamphlet is well illustrated.

The general design of the Marsh type of steam pump, made by the American Steam Pump Co., Battle Creek, Mich., is well known to many readers, but the special forms for low service and in connection with condensing apparatus have been so thoroughly worked out lately for a wide range of capacities, that a new catalogue of such pumps has become necessary. It gives full tables of dimensions of many styles.

The description of the air compressors made by the Laidlaw-Dunn-Gordon Co., 114 Liberty St., New York, requires a book of 175 pages. The line includes steam, electric, gas and power-driven compressors of single and duplex, simple and compound, single-stage and multi-stage types. Particular attention is paid to the explanation of the air-valve gearing, the air lift, the calculation of air mains, and the advantages of different types of apparatus for specific purposes.

The "Ideal Fitter," issued by the American Radiator Co., Chicago, is one of the best reference books for heating contractors, and in the new 1905 edition it has been enlarged in some respects so that it is more useful than ever before. Among the new data may be mentioned charts giving the steam pipe needed for heating water in tanks, and the size of heaters for the purpose, and charts giving the boiler capacity and piping needed for warming swimming pools.

The seventh general crane catalogue of Pawling & Harnischfeger, Milwaukee, Wis., is a large book containing admirable engravings of a great variety of cranes in power plants, steel works, machine shops, freight yards, erecting shops, storage yards, foundries, pumping stations, stone yards and various classes of industrial establishments. The construction of the cranes is fully explained, and the book also gives much useful information concerning overhead track systems.

The new catalogue of M. J. Drummond & Co., 182 Broadway, New York, is a cloth-bound book of 112 pages containing full data concerning the pipe, specials, gates, hydrants and other supplies commonly used by water and gas works engineers and superintendents. The tables of dimensions and weights are unusually complete.

The Kahn system of reinforced concrete is fully explained in catalogue D of the Trussed Concrete Steel Co., Detroit, Mich. Some of the various uses to which this system has been applied are shown and there are tables of safe loads, spans, amount and spacing of reinforcement and other information. The formulas on which the tables are based are described and several examples are solved to illustrate the application in them of the values in the tables.

The National Paint Works, of Williamsport, Pa., has issued a review of technical paints for metal that gives considerable information regarding the uses to which various paints are best adapted. This company does not manufacture proprietary paints, selling mainly in bulk to the large consuming and corporate trade, and is always prepared to furnish information in reference to the principal pigments and vehicles in its paints and the reasons why they are used.

The Hercules cement stone machine, which is adapted to making a large variety of both solid and hollow concrete building blocks, is described in the catalogue of the Century Cement Machine Co., Rochester, N. Y. The operation of the machine and a few of the different designs of blocks that can be made on it are illustrated, and a list of the sizes and designs of form plates that the company carries in stock is given.

The peculiar advantages of the three-wheel, double-cylinder steam road roller made by Julian Scholl & Co., 126 Liberty St., New York, are enumerated in its Circular 37, in which several views of one of these rollers at work on New York State roads are shown.

Flexible steel-armored rubber hose for transmitting steam and air in situations where the hose is exposed to injury is the subject of Bulletin 5,058 of the Sprague Electric Co., 527 West 34th St., New York.

The Cockburn Barrow & Machine Co., Jersey City, N. J., has issued its catalogue C on wheelbarrows for various kinds of service, hoisting buckets, concrete and grout mixers, shields and air-locks for tunnels and general supplies for contractors.

Circular 52-B on the Sullivan air compressors and rock drills of the Sullivan Machinery Co., Chicago, Ill., is a pamphlet of advance sheets of the new catalogue, No. 53, of that company, and contains descriptions of a portion of the standard types of these machines.

The Boyer pneumatic hammers and riveters, Little Giant pneumatic drills and boring machines, pneumatic geared hoists and trolleys and the extensive number of pneumatic machines manufactured by the Chicago Pneumatic Tool Co., Fisher Bldg., Chicago, Ill., are described in a handsome catalogue issued by that company. A number of full-page illustrations of the complete detail parts of the different machines, numbered and accompanied by explanatory keys, are shown in a way that is of value to the users of this class of machines.

No mill architect can afford to be without catalogue 28 of the H. W. Caldwell & Son Co., of Chicago. It is a cloth-bound manual of 736 pages devoted to elevating, conveying and power-transmitting machinery. It is one of those books that are a great credit to American manufacturers, being far more than a printed plea by a salesman. Under the head of conveyors and elevators the book describes the construction and uses of the screw, bucket and belt types, and explains a great variety of doors, chutes and other accessory apparatus used in various industries in connection with conveyors and elevators. A number of pages are devoted to various types of wood and steel pulleys, friction clutch pulleys, paper and iron friction pulleys and flywheels. The section devoted to gears is unusually complete, for it gives lists of the Caldwell patterns and the very large gear department formerly conducted by the Walker Co. Under power transmission apparatus there is a large amount of information concerning manila and wire rope sheaves, link-belt installations, leather belts, pillow blocks, hangers, step bearings, couplings, clutches, quills, shafts and grease cups. The closing part of the book relates to screens, wire cloth, scales, trucks, whitewashing machines and other miscellaneous equipment.

The Electro-Dynamic Co., Bayonne, N. J., has prepared a new series of circulars relating to their interpole, variable-speed motor. It will run at any desired speed within a very wide range, under any loading, within its capacity. This result is attained with a very light construction and with freedom from sparking at the commutator. The range of speed variation is 4:1 and may be increased if desired. The company also makes a line of constant speed motors and generators. The great interest in these motors shown by mill architects and shop managers has exhausted the old circulars, and in preparing the new edition the company has furnished information frequently requested by its correspondents.

THE AMERICAN SOCIETY OF CIVIL ENGINEERS

(By Telegraph.)

The two features of the convention of the American Society of Civil Engineers this week were the president's address, which appears elsewhere in this issue, and the discussions at the business meetings. About 450 members and guests were present at the opening meeting on Tuesday morning, when the Society was greeted by Chairman Augustus Mordecai of the local committee of arrangements. He pointed out that it was eminently proper for the organization to hold its annual convention in a city that was founded by Moses Cleveland, one of the great engineers of his time, and has ever since continued to occupy a prominent place in the engineering world. Its recent development as a center for oil refining, shipbuilding, and the machine tool industry is one of the most interesting features of American industrial growth. At the close of his remarks the Society was welcomed in the city's name by Director Cooley, in the absence of Mayor Johnson.

The discussion on the formation of local associations of the members of the Society was opened by a report from the Board of Direction presented by Secretary Hunt. It pointed out the great advantage of such associations for securing a widespread discussion of papers and for enabling their authors to present them personally at the nearest place where a local branch held a meeting. The Board was of the opinion that local associations should have constitutions modeled after those of the parent Society, except in respect to dues, officers and meetings. The Secretary stated that this project had been presented before the members of a number of districts and considerable information had been collected. A branch had been formed in San Francisco and on June 10 a successful meeting had been held, at which it was voted to widen the limits of the district beyond the 100 miles suggested by the Board of Directors. A paper was read and discussed by a dozen of those in attendance. At Chicago, the committee in charge of the subject reported that it would be impracticable to form a branch because it would conflict with the Western Engineers' Club, to which nearly all the local members of the Society belonged. This club has about 700 members, ample club rooms, a centrally located library of excellent character and a paid secretary. At Kansas City a branch has already been formed and much interest in its work is shown. At Cleveland practically nothing has been decided. At Pittsburg the feeling was not sympathetic toward a branch on account of the large local society already in existence. At St. Louis there was a sentiment in favor of an organization for social purposes, but not for the discussion of papers. A ballot taken by the members in the Philadelphia district was unfavorable to the project on account of the existence of the Engineers' Club of Philadelphia and the Franklin Institute.

When the subject was opened for discussion Mr. John C. Trautwine stated that his experience as a former secretary of the Association of Engineering Societies convinced him that the formation of local branches would weaken existing organizations so that neither they nor the branches would amount to much; in fact, he felt that local branches would have a tendency to retard the growth of the parent Society. In his opinion the proper way to increase the importance of the Society would be to create additional classes of membership and then absorb the local organizations, giving the members their appropriate classification in the American Society of Civil Engineers.

Mr. George S. Davison, of Pittsburg, stated that a committee of members of the Society in that district had been appointed to consider the subject, but each member of the committee was opposed to it. Of the 125 local members of the Society about half were active in the flourishing Pittsburg association, and while they had no opposition to branches as such, they felt that their value was questionable where local associations already existed. He personally favored getting the local members of the Society together in a social way, but not for the discussion of papers.

Mr. Oberlin Smith spoke in favor of local branches and urged their organization at all large cities. He did not approve the suggestion for increasing the number of grades of membership of the Society, as there were enough already to take in everybody interested in any way in engineering work.

Mr. George A. Ricker, one of the organizers of the Engineers' Society of Western New York, expressed the opinion that the project would tend to increase the membership of the American Society of Civil Engineers at the expense of its high standard of membership in the so-called active grades.

Mr. Bernard R. Green stated that in Washington, where there are about 80 members, the feeling was in favor of bringing them together for an annual dinner with social features, and at meetings for technical discussions, which could be attended by those who have no opportunity to be present at the regular meetings in New York. He could see no objection to such local meetings, to which all interested, whether members or not, would be invited, provided nothing was done to lower the standing of the Society's technical proceedings.

Col. H. S. Haines was strongly in favor of some sort of local organizations for promoting the personal acquaintance of the members. He had been in many places where the local members were not acquainted with each other and he found it difficult to meet some of them. Consequently he was in favor of local branches for social purposes and technical discussions, provided they were managed so as to avoid anything like rivalry with existing organizations. He urged those present to consider, also, the importance of refraining from any action that would lower the high standard of the Society.

Mr. Chase was in favor of some sort of local branches which would be related to each other like Masonic lodges. He suggested taking over local organizations and giving them the publications of the Society, but admitting the members to the Society only under present regulations and providing some sort of control over those who did not join any of its grades.

Mr. J. J. R. Croes, one of the members who reorganized the Society in 1857, pointed out the misapprehension that existed in some quarters concerning the various grades of membership of the Society, which he described. He thought that where there were no local engineering clubs it would be a good thing to organize branches for social intercourse, but it was important, in his opinion, for membership in the Society to stand for something accomplished and not for a connection with a sort of training school for inexperienced men.

It was finally determined at a subsequent session of the convention to leave undecided the question of the formation of branches along the lines indicated.

The Board of Directors reported unfavorably on the proposition of allowing that Board to name members to serve on public commissions on the ground that it has always been the policy of the Society to keep free from all imputation of being an association for promoting the pecuniary or personal interests of any of its members. This report was adopted by the Society.

GLOVER SEWAGE DISPOSAL PATENTS.

The city of Pawtucket has won a final victory in the litigation brought by the American Sewage Disposal Co. of Boston, seeking damages and injunction to prevent it from using septic tanks in combination with filtering beds in the operation of its sewage system, upon the ground that it was an infringement of the Glover patents. Judges Colt, Putnam and Aldrich in the United States Circuit Court of Appeals dismissed the company's bill on June 13. The Court decides that the city's claim is correct, that the septic tanks used alone or with filtering beds do not come within the device covered by the Glover patents, and hence the city does not infringe. The first Glover patent is held not to cover the septic tank, and the second Glover patent, issued in 1896, is held to simply cover a system of rapid filtration comprising two series of filter beds, one inside the ventilated structure and the other outside. The company claimed that the primary filter beds of the Glover patent were intended to be septic tanks, but this claim is not sustained by the Court.

BUSINESS NOTES.

The New York Continental Jewell Filtration Co. reports the following filter sales: Home Brewing Co., Richmond, Va.; State Hospital for Insane, Danville, Pa.; Wilson Laundry Machinery Co., Columbia, Pa.; residence of Dr. Thos. Kelly, Deal, N. J.; E. J. Garrison, bottler, Paterson, N. J., and Camm Bros., bottlers, Lynchburg, Va.

Among recent orders closed by the Westinghouse Electric & Mfg. Co. may be mentioned 180 h.-p. in variable speed and 130 h.-p. in constant speed induction motors, with transformers, for the Western Engineering & Construction Co.; a 1500-kw. engine-type generator and switchboard for the Cleveland Electric Ry. Co., sixteen quadruple car equipments of large capacity for the Cincinnati Traction Co., fifteen quadruple equipments of large capacity and 43 car motors of smaller size.

The National Wood Pipe Co., Los Angeles, Cal., has acquired the plant of the Puget Sound Pipe Co., at Olympia, Wash., and is now installing machinery for the manufacture of stave pipe and tanks and electrical machinery for operating the plant. The Puget Sound Pipe Co. has manufactured bored wood pipe from selected fir logs for thirty years, and this has been so satisfactory that its manufacture will be continued.

The Great Lakes Dredge & Dock Co., with main offices in the Chamber of Commerce Bldg., Chicago, has taken over the business of the Chicago & Great Lakes Dredge & Dock Co., the Lydon & Drews Co., the Hausler & Lutz Towing & Dock Co., and the Duluth Dredge & Dock Co. The work of the company will include bridges, foundations, dredging, breakwater construction, lighthouses, piers, pile driving, abutments, dock building, intake pipes and general pneumatic and submarine engineering. The officers of the company are: W. A. Lydon, president; T. C. Lutz, vice-president and general manager; Walter Cahill, second vice-president; W. J. McCarthy, secretary; H. C. Wild, treasurer; Geo. H. Jackson, asst. seretary and treasurer; D. McCarthy, general superintendent. The company will also have offices in Duluth, Toledo and Sault Ste. Marie.

While considerable damage was done in the recent fire at the plant of the Ohio Brass Co., Mansfield, O., the majority of the force is working and the brass department is in especially good condition, as the company has a large stock on hand and work has been resumed on the company's other specialties, so that there will be practically no delay in filling orders.

The United States Government has just awarded to the Central Foundry Co. the contract for 2,396 ft. of 8 in., 852 ft. of 10-in. and 384 ft. of 12-in. Universal pipe, to be installed in the new office building of the House of Representatives to be erected in Washington, D. C. Although the advertisement for water pipe and special castings issued by the Government for this building specified bell and spigot water pipe, Universal pipe was substituted in these sizes on account of its special advantages.

The Warren Steam Pump Co., Warren, Mass., has received from the Fall River Iron Works an order for three 4,000-h.p. condensing outfits. It has also received a contract for a 1,500,000-gal. pump for the Springfield, Mass., water works.

The Vellumoid Paper Co., 340 Main St., Worcester, Mass., is introducing a new sheet packing for engine and compressor cylinders, piping, valves, manholes and the like. It is made from a fiber treated chemically in such a way that moisture toughens it surprisingly. It is stated to contain no rubber, oils, alkalies or salts, and has been used with satisfactory results for 1½ years by the Walworth Mfg. Co.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Co., returned recently from a European trip with orders for 3,400 tools. This business has grown so rapidly that it has been necessary to purchase the factory and business of E. G. Eckstein in Berlin and that of the Lencke Co. in St. Petersburg to carry on manufacturing there. The company's plant at Fraserburgh, Scotland, is now in full operation.

The Dayton Pneumatic Tool Co. has opened an office at 421 Market St., San Francisco, which will be in charge of Henry Engels.

The Maryland Coal Co. has ordered from Wm. B. Scaife & Sons Co., Pittsburg, Pa., a steel-frame coal trestle 272 ft. long and 25 ft. wide, with steel tipple house 99x25 ft., for its mines at Wendel, Taylor Co., W. Va.

PERSONAL NOTES.

Mr. T. R. Atkinson has been appointed assistant State engineer of North Dakota.

Mr. John P. Holland, inventor of the submarine boat, has received the degree of master of science from Manhattan College, New York.

Mr. Alexander J. Wurtz has been appointed head of the Department of Electrical Practice in the Carnegie Technical Schools at Pittsburg.

Mr. C. H. Marquess has resigned as chief draftsman at the Charleston (S. C.) navy yard to become chief engineer for Moise Scheon, of Atlanta, Ga.

Prof. Wm. G. Raymond, dean of the college of applied science of the University of Iowa, has received the degree of doctor of laws from Washington University, St Louis.

Mr. R. K. Rochester, engineer of maintenance of way on the Vandalia R. R., has been appointed principal assistant engineer of that road with headquparters in St. Louis.

Mr. George S. Webster, chief of the bureau of surveys of Philadelphia, has been appointed temporary successor to Mr. John W. Hill, as chief of the bureau of filtration of that city.

Mr. H. R. Fardwell has been appointed sewer commissioner of St. Louis, Mo. Mr. Fardwell was connected with the civil engineering department of the Louisiana Purchase Exposition.

Messrs. Sidney E. George, of New York, and Fred W. Talbot, of Maine, have been appointed hydrographic aids in the U. S. Reclamation Service. Mr. George will report to the Washington office and will later be assigned to duty in the West.

The following officers of the Memphis, Tenn., Engineering Society were elected at a recent meeting: President, H. N. Pharr; vice-president, John A. Fox; secretary, C. C. Pashby; member of board of directors, Capt. A. J. Nolte.

Mr. E. D. Bolton, of New York, has been appointed resident engineer and superintendent of construction of the water filtration plant which is to be built by Toledo, Ohio. Mr. Chas. L. Parmelee, of New York, is consulting engineer for the city.

Mr. H. L. Weber, city engineer of Richmond, Ind., for eleven years, has been appointed chief engineer of the Ft. Wayne & Wabash Valley Traction Co., and of the Ft. Wayne, Blufton & Marion Traction Co., with headquarters at Ft. Wayne, Ind.

Mr. Charles N. McKergow, of McGill University, Montreal, Canada, has been appointed professor of mechanical engineering in the University of Virginia. Mr. John L. Newcomb, of Sassafras, Va., has been appointed professor of mechanical engineering in the same institution.

Prof. George W. Plympton, professor of civil engineering in the Polytechnic Institute of Brooklyn, N. Y., has resigned. Prof. Plympton has been connected with the Institute for over forty years, and has at the same time been head of the collegiate department of Cooper Institute.

Mr. James Mansergh, past president of the Institution of Civil Engineers and a member of the council of the Institution of Mechanical Engineers, died in London June 15. He was one of the most eminent civil engineers of our times and particularly noted as an authority on hydraulic works.

Captain William V. Judson, Corps of Engineers, U. S. A., has been transferred from the office of the chief of staff to Milwaukee to relieve Major James G. Warren, Corps of Engineers, U. S. A. Major Warren will proceed to Cincinnati to relieve Lieut. Col. Ernest H. Ruffner, Corps of Engineers, U. S. A.

Prof. William E. Gibbs has been appointed professor of physics in the Carnegie Technical Schools at Pittsburg, Pa. Prof. Gibbs graduated from Stevens Institute with the degree of mechanical engineer in 1882, and is widely known through the East for his applications of his knowledge of physics to practical operations.

Mr. Charles H. Ladomus, city engineer of Chester, Pa., and engineer of the Borough of Ridley Park, Pa., died recently at his home in that city. Mr. Ladomus spent a number of years in railroad engineering before taking up municipal work and had been city engineer of Chester for five years and borough engineer of Ridley Park for twelve years.

Mr. P. W. Price, of Oakdale, Pa., has been appointed assistant engineer in the U. S. Reclamation Service and ordered to report to the Washington office. Mr. Price is a graduate of Western University of Pennsylvania and has had considerable experience in railroad work and in water power development in the Northwest.

Mr. W. S. Kinnear, assistant general manager and chief engineer of the Michigan Central R. R., has been relieved of his duties as chief engineer in order that he may assume active charge of the construction of the tunnel which his company is to build under the Detroit River. Mr. Geo. H. Webb, assistant chief engineer of the Michigan Central R. R., will succeed Mr. Kinnear as chief engineer.

Messrs. John Birkinbine, of Philadelphia, Harry M. Brackenbridge, of Pittsburg, and John F. Whitworth, of Kittanning, have been appointed members of the Water Supply Commission of Pennsylvania by Gov. Pennypacker. This commission was created by an act of the last legislature of that state, and all applications for water charters will be referred to it, and it will also have general supervision over the streams of the state.

Mr. Morris R. Sherrerd, engineer and superintendent of the water department of Newark, N. J., has been appointed chief engineer of the board of public works and city surveyor of Newark. The office of assistant engineer of the water department has been abolished, and Mr. George Sanzenbacher, who has held that position, succeeds Mr. Sherrerd as engineer and superintendent of the water department. Mr. Louis C. Dittler has been appointed engineer of the street department.

Messrs. Roy Bullen, of the Lawrence Scientific School, Thomas F. Eastman of San Francisco, Cal., Alfred B. Mayhew of Tufts College, and Mr. E. W. Vernier of Purdue University, have been appointed engineering aids in the U. S. Reclamation Service. Mr. Eastman will be employed under Mr. L. H. Taylor on the Truckee Canal in Nevada, Mr. Mayhew will report to Washington and Mr. Vernier will be engaged under Mr. J. E. Field at Ft. Laramie, Wyo.

Mr. Everett O. Eastwood, instructor in mechanical engineering at Lehigh University, has been appointed assistant professor of mechanical engineering in the University of Washington at Seattle, Wash. Mr. Eastwood graduated from the University of Virginia in 1896. He then spent four years in graduate work and instructing in that university, after which he attended and graduated from the Massachusetts Institute of Technology. He was employed in the Government navy yard at Washington for one year and with the Fore River Shipbuilding Co., Quincy, Mass., for one year.

Mr. Edward Duryee has been appointed cement expert in the U. S. Reclamation Service and will remain in charge of cement works at the Roosevelt Dam in Arizona. Mr. Duryee graduated from Rutgers College and afterward spent one season with the New Jersey Geodetic Survey. He was engaged in 1879 in experimental investigations and in perfecting the rotary kiln for metallurgical use, and following that was assayer and metallurgist for several smelting companies in New Mexico, Colorado and California. From 1892 to 1894 Mr. Duryee was superintending chemist for the Montezuma Portland Cement Co., and from 1894 to 1903 was chemist for the California Portland Cement Co. Since 1903 he has been in the Reclamation Service.

Dr. Henry Sandwith Drinker, of Haverford, Pa., has been elected president of Lehigh University to succeed the late Dr. Thomas M. Drown. Dr. Drinker graduated from Lehigh in the School of Mines in 1871, and immediately afterward entered the mining department of the Lehigh Valley R. R. at Wilkesbarre, Pa. He was transferred to the Easton and Amboy division of that road in 1872 and was engaged in the construction of the Musconetcong Tunnel for three years. In 1876 he was admitted to the bar and took up a practice of railroad and corporation law, becoming attorney and eventually solicitor of the Lehigh Valley R. R., which latter position he still holds. Dr. Drinker was at two different periods assistant to the president of the Lehigh Valley R. R., and was vice-president of the East Jersey Water Co. while that railroad was interested in it. He has written a treatise on tunneling which is widely accepted as an authority on the subject.

The accident to the 18-hour New York-Chicago Express at Mentor, Ohio, on Wednesday night, resulted in the death of nineteen people and the injury of a number more. Thomas R. Morgan of the Wellman-Seaver-Morgan Co. was burned to death in the wreckage and Charles H. Wellman of the same company was so badly scalded and burned that his recovery is doubtful. The wreck occurred at a switch over which a train had passed safely less than an hour before, and is believed to have been caused maliciously, for the switch was locked open so that any train reaching it would be derailed.

Mr. Frank G. Randall has resigned as vice-president and general manager of the National Electric Co. to become manager of the New York district of the Allis-Chalmers Co., with his headquarters in New York. Mr. Randall has been closely identified for years with street railway supply interests. He began his business in the office of his father, who was an importer of special grades of iron and steel, and after two years in that work he took up railroad work, entering in the motive power department. He was chief clerk of the motive power department of the Boston & Lowell R. R. when that road was absorbed by the Boston & Maine R. R., following which he entered the shops of the Tripp Mfg. Co., eventually becoming superintendent of the works of that company. He left the latter position to become eastern sales agent for the J. G. Brill Co., and was later transferred to Chicago in the interests of that company. After six years in Chicago he accepted the position of eastern sales agent for the Christensen Engineering Co., becoming in turn general sales agent of that company and its successor, the National Electric Co., and then vice-president and general manager.

Mr. G. R. Wadsworth has become associated with J. G. White & Co. as assistant to the construction manager, with headquarters at the home office of that company, in New York. Mr. Wadsworth graduated from the Massachusetts Institute of Technology in civil engineering with the class of 1898 and has been continuously in the employ of the New York Central & Hudson River R. R. since then. He has recently had supervision of the design and been in charge of construction of different parts of the terminal improvements which that railroad is making in the vicinity of New York City. Mr. Eugene Lentilhon has also become associated with J. G. White & Co., and is now en route for Chili to investigate a number of important engineering projects. Mr. Lentilhon is a graduate of Sheffield Scientific School and for several years following his graduation was connected with the dock department of New York City, where as assistant engineer he had supervision of the improvements and repairs along the North River from the Battery to 14th St. Since 1897 Mr. Lentilhon has been engaged in contracting in New York.

Mr. Andrew Onderdonk, general manager of the New York Tunnel Co., the contracting firm which is constructing the twin tunnels of the New York Rapid Transit Subway under the East River, died at his summer home near Oscawana, N. Y., June 21. For thirty-five years Mr. Onderdonk was engaged in contracting, and during that time has carried to completion many notable engineering works. Prior to 1880 he was engaged in harbor improvement work at San Francisco and between 1880 and 1885 he built 400 miles of the Canadian Pacific R. R. in British Columbia. He constructed the Entre Rios R. R. in South America in 1886. He was awarded the contract for several sections of the Chicago Drainage Canal, and after completing that work built nine miles of water works tunnels in Chicago, and in 1895 undertook the construction of the Trent Valley Canal for the Canadian Government. He built a double track railway tunnel at Hamilton, Ont., and in connection with the Union Bridge Co., erected the Northwestern Elevated R. R. in Chicago. He was awarded the contract for four sections of the Soulange Canal in Canada, and for half of the Victoria bridge at Montreal. Two of his latest contracts were the dredging of the New Ambrose Channel in Lower New York Bay and an interest in the construction of the Jerome Park reservoir in New York City.

CONTRACTING NEWS

OF SPECIAL INTEREST TO CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Headland, Ala.—Arthur Pew, of Atlanta, Ga., is preparing plans for water-works for Headland, supply to be from artesian wells. Bonds will be voted later.

Yuma, Ariz.—Bids will be received at the office of the Superv. Engr., Braly Bldg., Los Angeles, Cal., Aug. 17, for the construction of about 12 miles of dike for the reclamation of Yuma Valley, Ariz., as advertised in The Engineering Record.

*Vallejo, Cal.—The Bd. of City Trus. is reported to have on June 7 awarded to Geo. H. Tay Co., San Francisco, the contract for water pipe, at a cost of $90,000.

Sebastopol, Cal.—Engr. N. S. Frost, of Petaluma, writes that the proposed water works and sewerage system for Sebastopol will cost $50,000. Date of receiving of bids not yet decided upon. Wm. T. Searles, Town Clerk.

Wilmington, Del.—Bids will be received by the Water Dept. (Theo. A. Leisen, Ch. Engr.) at 1.30 p.m. June 26 for constructing a pumping station, 60x110 ft., of brick with terra-cotta trimmings.

Wyoming, Del.—See "Power Plants, Gas and Electricity."

Wilmington, Del.—The following are reported to be the bids opened by the Bd. of Water Comrs., June 16, for two 300-h.p. water tube boilers: (*a*) without heater, (*b*) with heater: Altman & Taylor Co., *a* $9,028, *b* $10,528; Edge Moor Iron Co., *a* $7,300, *b* $8,770; Maxim Co. of Pa., *a* $5,250, *b* $6,250; Babcock & Wilcox Co., *a* $8,000, *b* $9,456; Heine Safety Boiler Co., *a* $6,322, *b* $8,322.

Atlanta, Ga.—Park Woodward, gen. mgr. Water Bd., recommends another and larger main from river station to reservoir; a pump of at last 15,000,000 gal. daily capacity for No. 2 station; that the small pipe in the business and manufacturing section of city be replaced with larger mains; the construction of a duplicate clear-water basin; increase of filter capacity, etc.

Montpelier, Idaho.—Washington Jenkins, Engr., Montpelier Irrig. Dist., writes that all bids opened on June 10 for furnishing material and constructing the Montpelier irrigation canal have been rejected and new bids will be received later.

Thebes, Ill.—See "Sewerage and Sewage Disposal."

Flora, Ind.—The question of constructing water-works is reported under consideration.

Tama, Ia.—It is reported that bids are wanted until July 11 for improving the water system, including power house, pumping machinery, boilers, mains and connections. H. A. Ferguson, City Clk.

Eldora, Iowa.—Bids will be received until June 30 by L. F. Brown, Chmn. Purchasing Com., for furnishing 850 ft. 4-in. c. i. water pipe, 2 regular tees, 4x4x4 standard c. i. and 2 regular plugs 4-in. standard c. i. Also substitute bids to furnish minimum car load of said material.

Frontenac, Kan.—C. J. Devlin is reported to have secured a franchise for water-works.

Newport, Ky.—Supt. of Water Wks. Glazier is reported to have recommended the construction of a filter plant for the water-works.

Hammond, La.—Bids will be received until July 20 by S. L. Powlett, Mayor, and the Bd. of Aldermen for $30,000 water and drainage bonds.

Oxford, Mass.—A. M. Chaffee, of the Oxford Water Co., writes that it is proposed to construct water-works at a cost of $65,000. No engineer selected as yet.

Great Barrington, Mass.—At a meeting of the Great Barrington Fire Dist. June 16 the report favoring the development of the East Mountain water supply was rejected and the chairman was instructed to appoint a committee of 25 members to consider the different possible sources of supply and report to a meeting to be held Sept. 15.

Kalamazoo, Mich.—The Grand Rapids & Indiana R. R. Co. (E. H. Barnes, Res. Engr., Grand Rapids) is reported to have decided to construct a water plant at Kalamazoo, to cost $8,000.

Melrose, Minn.—See "Power Plants, Gas and Electricity."

*Nevada, Mo.—Gray & Suter, of Fulton, are reported to have secured the contract for constructing water-works at the Hospital for Insane at Nevada for about $12,000.

Havre, Mont.—Bids will be received by J. M. Kelly, City Clk., on July 18 for furnishing material and installing a system of water mains and constructing a 500,000-gal., concrete reservoir, as advertised in The Engineering Record.

Lumberton, N. J.—Bids are wanted June 30 for the construction of water-works, as advertised in The Engineering Record.

Ocean City, N. J.—The Corsons Inlet Water Co., of Ocean City, is reported incorporated with a capital of $100,000 to construct and operate water works in Upped Township. Incorporators: Reuben W. Edwards, Jos. D. Scull, Jas. M. Chester and others.

New York, N. Y.—Bids will be received until July 5 by John T. Oakley, Comr. Water Supply, Gas and Electricity, for furnishing and delivering single and double-nozzle New York case hydrants, Boros. Manhattan and Bronx.

A report from the engineer of the Dept. of Finance as to the amount of money required to carry out improvements in the water-supply system is reported to have been submitted to the Bd. of Estimate, in which the engineer recommends that the Bd. authorize an appropriation of $5,640,000 to provide for the improvement as proposed and suggests that the amount be divided as follows: Manhattan and the Bronx, $2,150,000; Brooklyn, $3,390,000, and Queens, $100,000.

*The contract for constructing a reservoir, including the building of a masonry dam across Cross River east of Katonah Sta. (bids opened by the Aqueduct Comrs. May 31), has been awarded to McArthur Bros. Co. and Winston & Co., of New York and Clinton, Mass., for $1,246,212. For list of bids received for this work see issue of The Engineering Record June 10.

Brooklyn, N. Y.—Bids will be received until July 29 by John T. Oakley, Comr. Water Supply, Gas and Electricity, N. Y. City, for furnishing and installing electrically

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**Items marked thus give the names of parties awarded contracts.*

driven pumps, with all appliances complete, for high-pressure fire service, three in pumping station to be erected at Willoughby and St. Edwards Sts. and five in pumping station at Gurman and Joralemon Sts.; also July 5 for furnishing c. i. pipe and special castings, all in Boro. Brooklyn.

Staatsburg, N. Y.—It is reported that surveys have been completed for water-works, to cost about $20,000.

Lyons Falls, N. Y.—Knight & Hopkins, of Rome, are reported to have been selected to prepare preliminary plans for water works. probable cost $30,000.

Newton, N. C.—W. B. Gaither, Mayor, writes that the question of granting a water-works franchise to the National Water Wks. & Power Co. is under consideration.

Roswell, N. M.—Haynes & Bonney and J. A. Jones have petitioned City Council for franchises for water-works.

Fredericktown, O.—Harry L. Ralston, City Clk., writes that it is proposed to construct water-works, at a cost of $20,000. Bonds have been sold. Engineer, Thos. Cureton, of Columbus.

**Crestline, O.*—The National Constr. Co., of South Bend, Ind., is reported to have secured the contract for the construction of water-works for $73,191. Engineers, The Walter P. Rice Eng. Co., of Cleveland.

Dresden, O.—J. H. Diehl, of Scio, is reported to have secured a franchise for water-works.

Cleveland, O.—The City Council is reported to have authorized an expenditure of $40,000 for pumps at Fairmount pumping station.

Columbus, O.—Bids will be received until July 5 by the Bd. Pub. Service (Chas. H. Frank, Secy.) for furnishing approximately 11,000 tons of 4 to 36-in. c. i. pipe and 65,000 lbs. special castings; also 20 tons pig lead of 2,000 lb. each, f. o. b. cars Columbus, all for use in the Water Wks. Dept.

**Cincinnati, O.*—The contract for two pumping engines and boilers of 2,500,000 gal. capacity for the Western Hills Pumping Station on Queen City Ave. in Fairmount, is stated to have been awarded on June 16 to the Snow Steam Pump Co., of Buffalo, for $33,600.

*Guy M. Gest, Union Trust Bldg., is stated to have secured the contract for laying water mains in Cutter and Wade Sts., Western and McLean Aves. and other streets, for $36,923.

Smithton, Pa.—The question of constructing water-works is reported under consideration here.

Panama.—Bids will be received by the Isthmian Canal Comn. at Washington, D. C., July 19 for furnishing a system of pumps and engines, as advertised in The Engineering Record.

West Lebanon, Pa.—Daniel Weaver, of Weaverstown, is reported interested in providing West Lebanon with a water supply, at a cost of $15,000.

Jamestown, Pa.—Geo. B. Zahniser, of New Castle, is reported to have completed plans for water-works, to cost $24,000.

Allegheny, Pa.—See "Sewerage and Sewage Disposal."

Philadelphia, Pa.—Mayor Weaver is stated to have on June 20 revoked the $700,000 contract which the D. J. McNichol Co. had with the city to supply sand and gravel for the filter beds.

Sumter, S. C.—Bids are wanted until July 1 for $116,000 water-works bonds. Address C. M. Hurst, Secy. Bd. Comrs. Pub. Wks.

Columbia, S. C.—The City Council is reported to have instructed Water Works Comn. to go ahead with the work already outlined by Engr. Ludlow for new water-works, the supply to be taken from Broad River, and the Commission will soon be ready to award contracts. The proposed bond issue of $400,000 has been validated by a recent decision of the Supreme Court.

Lafollette, Tenn.—See "Power Plants, Gas and Electricity."

Denton, Tex.—See "Power Plants, Gas and Electricity."

Mexia, Tex.—The water-works are reported to have been sold to A. M. Turner and associates, of Hillsboro. It is stated that the new company will expend about $75,000 in enlarging and improving the plant.

Petersburg, Va.—The Bd. of Aldermen is reported to have confirmed the ordinance passed by Council providing for an issue of $75,000 bonds for the extension of water mains, sewers and improvement of sidewalks.

Tahoe, Cal.—The following are the bids opened at the office of the U. S. Reclamation Service, Hazen, Nev., on June 15 for the construction of outlet and controlling works and the bridge at Lake Tahoe, Tahoe City, Cal.: (*a*) Edw. Malley, Rialto Bldg., San Francisco; (*b*) Burrell Constr. Co. Oakland; (*c*) Cotton Bros. & Co., Oakland; (*d*) E. B. & A. L. Stone Co., Oakland; Wm. Degen, Fresno (2 bids) (*e1*) entire work (*e2*) separate items; (*f*) City Street Improv. Co., 512 Mills Bldg., San Francisco.

	a	*b*	*c*	*d*	*e1*	*e2*	*f*
90,000 cu. yds. excav., Class 1	$.25	$.179	$.23½	$.35	$.40	$.45	$.79
1,000 cu. yds. excav., Class 2	.50	.49	.90	.75	.50	.55	.85
100 cu. yds. excav., Class 3	1.00	1.50	.50	1.00	.70	.75	1.00
100 cu. yds. excav., Class 4	1.50	1.90	1.00	1.25	.95	1.00	1.00
1,000 cu. yds. overhaul	.04	.02½	.01½	.02	.01½	.01½	.05
500 cu. yds. concrete	10.00	14.90	10.00	12.00	11.00	14.00	8.10
1,000 sq. yds. paving	1.00	1.90	1.00	1.50	2.50	4.00	2.75
160 flashboards, with hooks, 3x12x5-4 in.	1.00	1.25	.50	1.00	1.30	2.50	1.30
40 flashboards, without hooks, 2x8x5-4 in.	.25	1.00	.25	.50	.40	1.00	.90
10 flashboards, foot planks, 3x12x14 in.	1.00	1.50	.80	1.75	2.50	5.00	2.50
8,000 lbs. cast iron	.07	.08	.05	.06	.08	.08	.10
1,000 lbs. steel in place in concrete	.07	.16	.10	.06	.06	.06	.10
100 cu. yds. puddling	1.00	1.90	.65	1.50	.40	.40	.20
5,000 cu. yds. dredging in lake	.40	1.00	1.20	2.00	1.20	4.50	1.97
Total	$32,200	$32,560	$34,878	$50,882	$51,669	$75,970	$90,039

Columbus, O.—Bids were opened by the Bd. of Pub. Service (Julian Griggs, Ch. Engr.) on June 15, for the construction of water purification works. The following are the totals, also unit prices, on some of the items: (*a*) Westwater & Casey, Columbus, $524,209; (*b*) Thos. Lightbody, $542,960; (*c*) Ambrose B. Stannard, New York, N. Y., $555,748, and Sullivan, Murphy & Miles, Columbus, $582,355.

	a	*b*	*c*	*d*
94,000 cu. yds. excav.	$.60	$.35	$.52	$.35
25,400 cu. yds. rolled embnkmt	.40	.20	.43	.09
2,860 sq. yds. broken stone or gravel backing	.90	1.00	.65	1.24
860 sq yds. stone paving	1.60	3.00	8.00	5.72
2,800 lin. ft. railroad track ballasted	2.00	2.10	4.00	2.30
9,760 cu. yds. puddle	1.90	2.20	3.50	1.75
110 cu. yds. brick masonry	12.00	11.00	11.00	12.00
1,060 cu. yds. concrete, Class A	18.50	8.00	9.00	7.00
320 cu. yds. concrete, Class B	13.00	8.00	9.50	10.00
580 cu. yds. concrete, Class C	12.50	8.00	13.45	14.00
3,400 cu. yds. concrete, Class D	6.95	8.00	8.80	10.00
1,950 cu. yds. concrete, Class E	7.90	8.00	9.00	15.00
8,350 cu. yds. concrete, Class F	6.30	8.00	5.90	7.50
10,560 cu. yds. concrete, Class G	6.60	8.00	6.10	6.75
4,980 cu. yds. concrete, Class H	6.40	8.00	5.20	4.75
120 cu. yds. concrete, Class I	25.00	8.00	10.00	13.66
236 tons twisted steel rods	57.00	45.00	65.00	60.00
390 tons cast iron pipe	35.00	45.00	47.00	40.00
152 tons bell and spigot special castings	65.00	100.00	97.00	85.00
80 tons flanges, special castings	85.00	115.00	120.00	97.50
600 lin. ft. 2½-in. wrought-iron pipe	.55	.50	.46	.33
250 lin. ft. 3-in. wrought-iron pipe	1.00	.60	.60	.50
30 lin. ft. 4-in. wrought-iron pipe	2.00	.75	.90	.68
20 10-in. gate valves, hydraulically operated	65.00	90.00	100.00	74.00
40 20-in. gate valves, hydraulically operated	200.00	275.00	230.00	250.00
10 filter controllers	825.00	..	875.00	900.00
1 wash water controller	2000.00	..	2100.00	1700.00
Air controller	500.00	..	500.00	685.00
Gage board and appurtenances	1000.00	..	950.00	1000.00
4 depth recorders, Type A	110.00	..	105.00	130.00
1 depth recorder, Type B	165.00	..	120.00	140.00
1 depth recorder, Type C	175.00	..	150.00	170.00
3 depth recorders, Type D	165.00	..	120.00	140.00
2 water level indicators for clear water reservoir	160.00	..	105.00	145.00
1 water level indicator for settling basin	125.00	..	98.00	145.00
Stirring machinery for lime saturators	6600.00	4200.00	2200.00	12738.00
3 stirring machines for lime slaking and lime solution tanks	385.00	400.00	500.00	1544.00
4 soda and coagulent dissolving tanks	220.00	80.00	130.00	145.00
3 lime-slaking tanks	77.00	80.00	120.00	80.00
Chemical feed regulators	2200.00	1500.00	680.00	5879.00
10 strainer systems	374.00	450.00	1860.00	2688.00
10 air systems	550.00	1050.00	150.00	1498.00
300 cu. yds. filter gravel	6.90	5.00	2.00	2.00
1,010 cu. yds. filter sand	6.90	5.00	8.00	1.75

Casper, Wyo.—The following are the bids opened June 15 at the office of C. S. Fitch, Superv. Engr., U. S. Reclamation Service, Chamber of Commerce Bldg., Denver Colo., for the construction of the Pathfinder Dam and auxiliary works, at a point about 50 miles southwest of Casper, to impound the flow of North Platte River: (*a*) Keltic Stone Co., Barber Bldg., Joliet, Ill.; (*b*) Geddes & Seerie Stone Co., Denver, Colo.; (*c*) Kilpatrick Bros. & Collins Contr. Co., Beatrice, Neb.; (*d*) Wy[illegible]ebach & Russell, Sturgis, S. D.; (*e*) Bradbury & O'Gara, Denver, Colo.

	a	*b*	*c*	*d*	*e*
50,000 cu. yd. masonry for dam above elevation	$8.40	$7.60	$7.95	$5.78	$4.30
3,000 cu. yd. masonry for dam below elevation	8.65	9.95	12.00	10.40	6.48
Excavation for foundation of dam and for spillways:					
2,500 cu. yd., Class 1	1.21	2.50	3.00	1.00	4.00
500 cu. yd., Class 2	3.00	6.70	10.00	3.00	4.60
2,000 cu. yd., Class 3	2.50	4.30	3.00	1.50	1.15
1,000 cu. yd. concrete in bridges, towers, spillways and guide walls	4.75	7.60	7.50	6.50	5.90
Hauling cement, 40,000 bbl., from Casper to dam site	3.00	3.23	3.25	3.00	2.75
Total	$580,225	$564,850	$589,500	$453,700	$364,940

Spokane, Wash.—Press reports state that bids will be received by the Bd. Pub. Wks. until July 5 for laying about 37,160 lin. ft. 30, 24 and 20-in. mains in Mission Ave. and Hamilton St.

**Milwaukee, Wis.*—The contract for furnishing 210 tons of 42-in. c. i. pipe and 21 tons special castings (bids opened June 16) has been awarded to U. S. C. Iron Pipe & Fdry. Co., Chicago, Ill., at $27.25 and $85 per ton, respectively.

Milwaukee, Wis.—Chief Meminger, of the Fire Dept., in his annual report recommends the extension of the high-pressure pipe line system to the manufacturing districts.

Sarnia, Ont.—J. D. Stewart, Town Clk., writes that the citizens voted June 5 in favor of improving the water-works. According to press reports about $57,000 will be expended.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Mobile, Ala.—See "Electric Railways."

Oakland, Cal.—City Engr. Turner is reported to have decided to recommend to Council that steps be taken to construct outlet sewers for all districts lying south of the 7th St. railroad tracks, both in East and West Oakland; probable cost of work, $100,000.

San Francisco, Cal.—Thos. P. Woodward, City Engr., writes that it is proposed to construct a pumping station at Golden Gate Park, near the ocean beach, in connection with the West Richmond sewerage district, to prevent the sewage defiling the beach. The preparation of plans has not yet commenced.

Sebastopol, Cal.—See "Water."

Macon, Ga.—Bids are wanted July 8 for the extension of the sewerage system a distance of 6 to 10 miles to a suburb recently annexed. J. W. Wilcox, City Engr. Wm. A. McKenna, Chmn. Sewer Com.

Covington, Ky.—City Engr. W. E. Gunn is reported to have completed plans and estimates for an extension to the Willow Run sewer from 15th St. south. It will be of concrete, 6 ft. wide and 8 ft. deep, and cost about $12,465.

Chicago, Ill.—The following are the bids opened June 20 for 4 centrifugal and screw pumping engines for the sewage pumping station at Lawrence and Evanston Aves.: Allis-Chalmers Co., Chicago, $127,900, and Camden Iron Wks., Camden, N. J., $129,000.

Thebes, Ill.—Richard H. Phillips, Security Bldg., St. Louis, Mo., has prepared estimates for the construction of a sanitary sewerage system and for water works.

Rock Falls, Ill.—The question of constructing a sewerage system is reported under consideration.

Lafayette, Ind.—The question of constructing a sewerage system on the north side is reported under consideration here.

Indianapolis, Ind.—City Engr. B. J. T. Jeup is reported to be preparing plans for a sewerage spstem for the western part of North Indianapolis. The main sewer will follow along course of canal, with branches in adjoining streets. The storm waters and surface drainage will be carried into Fall Creek by this sewer, while sewage will be sent away into White River interceptor at 23d St. and Northwestern Ave.

Laporte, Ind.—Bids opened June 12 for constructing 2,600 ft. of brick sewer have been rejected. Only two bids were received—W. Wise, $2.27 per lin. ft., and Emil Johnson, $2.21.

Idagrove, Ia.—The City Council is reported to have selected Prof. A. Marston, of the Iowa State College, Ames, Ia., to prepare plans for a sanitary sewerage system.

Hammond, La.—See "Water."

Westfield, Mass.—Bids will be received until July 17 by the Com. on Surface Sewerage for constructing brick and pipe storm water sewers, as advertised in The Engineering Record.

Chisholm, Minn.—W. A. Masters, Village Recorder, writes that bids will be opened at 9 a.m. June 26 for constructing a sewerage system; probable cost, $10,000 to $15,000. Engineer, W. B. Patton, Duluth.

Janesville, Minn.—Bids will be received until June 29 by the Common Council (Ernest Miller, Pres.) for constructing a sewer in a portion of 1st St.

Anaconda, Mont.—Acting City Engr. Kneidson is reported to have completed his report on the construction of a new main line sewer in the eastern addition and estimates the cost at about $9,107.

Jersey City, N. J.—See "Railroads."

**Asbury Park, N. J.*—The Watson Machine Co. is reported to have secured the contract on June 9 for constructing the new ocean sewer outlet of 12-in. pipe for $7,000.

Newark, N. J.—M. R. Sherrerd, Ch. Engr. and City Surveyor, writes in regard to the construction of a sewerage system in Newfoundland Township, that this work is of a special nature which will require legislation. Newfoundland is in the Pequannock watershed, the source of Newark's water supply, and it is proposed that this city construct the sewerage system to protect its water supply.

Edw. S. Rankin, Ch. Engr., Dept. of Sewers, is stated to have submitted to the Sewer Com. of the Bd. of Pub. Wks. plans for the construction of a sewer in Sussex Ave. bet. Boyden and High Sts.

Beverly, N. J.—Wm. B. Cramer, City Clk., writes that nothing definite has yet been done with regard to constructing a sewerage system.

Kearny, N. J.—Press reports state that T. C. Wildman, Town Clk., will receive new bids for a sewer in Tappan St.

Cape May, N. J.—The City Council is stated to have passed an ordinance providing for the extension of the sewerage system in the East Cape May tract.

Trenton, N. J.—Bids will be received until June 27 by the Bd. Chosen Freeholders (D. L. Cook, Dir.) for furnishing materials and laying a 48-in., iron pipe culvert and building retaining walls, crossing Brunswick Pike near Delaware & Raritan Canal Bridge in the township of Lawrence. Frank J. Eppele, Co. Engr.

New York, N. Y.—Bids will be received until June 28 by John F. Ahearn, Boro. Pres., for furnishing materials, constructing, altering and repairing sewers in portions of 7 streets. Engineer's estimate: 1,372 lin. ft. 3-ft. 6-in. by 2-ft. 4-in. brick sewers; 1,895 lin. ft. 12-in. vitr. stoneware pipe culvert; 239 lin. ft. 4-ft. by 2-ft. 8-in. brick sewer, including timber found, and excav. trench for outlet; 3,350 rock to be excav. and removed; 89,000 ft. B.M. timber and planking for bracing and street piling. Boro. Manhattan.

**Items marked thus give the names of parties awarded contracts.*

East Syracuse, N. Y.—Bids were opened by the Sewer Comrs. June 15 for constructing sewage disposal works. The following are the totals of bids received and also unit prices on some of the items: (Engineers, Morrison & Farrington, Dillaye Memorial Bldg., Syracuse.) (*a*) Frank Pidgeon, Saugerties, $21,391; (*b*) De Nalla & Klingburg, Kingston, $19,652; (*c*) C. T. Hookway, Syracuse, $16,046; (*d*) C. R. Lewis, Ilion, $20,954.

	a	*b*	*c*	*d*
2,000 cu. yds. earth excav.	$.30	$.30	$.25	$.85
3,000 cu. yds. material for filter beds	2.40	1.80	1.50	2.00
2,220 lin. ft. trenching and backfill. for 8 and 10 in. pipe—double line	.58	1.25	.60	.48
1,500 lin. ft. trenching and backfill. for 8 and 10-in. pipe—single line	.45	.65	.40	.30
500 cu. yds. concrete	8.75	6.75	6.00	8.00
50 lin. ft. 8-in. vitrified tile pipe	.40	.30	.30	.25
3,525 lin. ft. 10-in. vitrified tile pipe	.50	.40	.40	.60
3,000 lin. ft. 4-in. closed drain tile	.30	.10	.06	.15
150 lin. ft. 4-in. C. I. soil pipe	.22	.30	.40	.50
2,950 lin. ft. 8-in. C. I. pipe	.75	.85	.80	.90
84 lin. ft. 10-in. C. I. pipe	.80	1.20	1.00	1.20
4 manholes under 4 feet	30.00	20.00	20.00	35.00
3 manholes under 10 feet	40.00	40.00	40.00	40.00
10,800 lbs. special castings	.05	.05	.05	.07
14,000 10 or 12-in. I-beams	.06	.05	.05	.05

Binghamton, N. Y.—S. M. Baird, City Engr., writes that the citizens voted June 2 to issue $85,000 bonds for constructing a sewer in the 4th Ward.

**Albany, N. Y.*—The Bd. of Contract and Supply is stated to have on June 13 awarded contracts for sewer work as follows: Sewer in Orange St. from Albany Basin to Northern Boule., to Jos. F. Sheehan for $25,129, and for sewer in S. Pearl St. from State to Schuyler St., to John Doyle for $10,067.

Fulton, N. Y.—Bonds to the amount of $15,000 are reported sold, to be used to aid in the construction of the west side sanitary sewer.

Bronxville, N. Y.—The following are the bids opened June 16 for the construction of sewers (Engineer, Chas. W. Leavitt, Jr., 15 Cortlandt St., New York), *a* for work complete, *b* amount to be deducted if contract is secured: Abbot, Gamble Co., *a* $55,100; Peace Bros., *a* $53,389, *b* $2,500; Neff Co., *a* $48,562; Grady, Kearns & Hart, *a* $44,390; Cody & Nolan, *a* $43,967; M. J. Leahy, *a* $37,470; Bellew & Merritt, *a* $31,219, *b* $1,000; Greenberg & Stevenson, *a* $28,818, *b* $100; DeNallo & Klingberg, *a* $29,668, *b* $1,168. For pumps and motors, Greenberg & Stevenson bid $2,460, Camden Iron Wks. $2,100 and Reis & O'Donovan, $1,590.

Buffalo, N. Y.—The lowest bid opened on June 16 by the Bd. of Pub. Wks. is stated to have been submitted by Miller & Franklin, 669 7th St., for $6,298.

Mamaroneck, N. Y.—Bids will be received until July 12 by the Bd. Village Trus. for constructing approximately 4 miles of sewers. John M. Farley, Engr., 5 Court St., White Plains, N. Y.; Chas. W. Buckter, Village Clk.

Medicine Hat, N. W. Ter.—The Town Secy.-Treas. writes that it has not yet been decided when the question of constructing a $60,000 sewerage system will be submitted to a vote.

Cleveland, O.—Local press reports state that contracts will probably soon be let for the extension of the Case Ave. intercepting sewer to the city limits.

Alliance, O.—O. E. Pfouls, City Engr., writes that bids will be received Aug. 5 for 25,000 lin. ft. of 6 and 8-in. sanitary pipe sewers; probable cost, $20,000.

Bowling Green, O.—E. L. Spafford, Co. Surveyor, writes that there has been talk of constructing a trunk sewer in outlet ditch, but no action has yet been taken.

**Cambridge, O.*—Stitt & Kunse, of Wabash, Ind., have secured the contract for extensions to the sanitary and storm sewerage systems (bids opened June 12) for $6,215. O. M. Hage, City Engr.

Chillicothe, O.—H. M. Redd, City Engr., writes that bids will be received by the Bd. of Pub. Service July 1 for constructing about 6,000 ft. of 8, 10 and 12-in. pipe sewers.

Reading, Pa.—Mayor Gerber has signed the ordinances providing for the levying of a tax for house sewers and for increasing the capacity of sewage-disposal plant at Millmont.

**Gallitzin, Pa.*—W. G. Stahl & Sons, of Altoona, are reported to have secured the contract for sewers (bids opened June 7); cost reported to be $8,933.

Allegheny, Pa.—Bonds to the amount of $910,000 have been sold, to be used for new sewers, water mains, paving, new engine houses and park improvements.

Groton, S. D.—Bids will be received until July 17 by W. A. Burnham, City Aud., for constructing an extension to the sewerage system.

St. Elmo (P. O. Chattanooga), Tenn.—The St. Elmo Sewerage Co. is reported to have applied for a charter in the office of the County Clk.; the company includes A. D. Davis, H. B. Wilson, J. A. Patten and others; capital, $10,000. The company will begin in the near future the construction of a sewerage system at 9th St. in St. Elmo.

**Houston, Tex.*—J. C. Kelsoe, of Galveston, is stated to have on June 15 secured the contract for the construction of the sewer extensions in the Fair Grounds addition for $11,822.

Petersburg, Va.—See "Water."

BRIDGES.

Notes Arranged Alphabetically by States.

Argenta, Ark.—The construction of a viaduct at Ft. Smith Crossing across the railway tracks is under consideration.

Weaverville, Cal.—It is stated that bids will be received until July 6 by the Co. Comrs. for constructing a combination bridge, 140-ft. span, across Trinity River near Lowden's Ranch; estimated cost, $6,000.

Madera, Cal.—The construction of a steel bridge across San Joaquin River between Madera and Fresno counties is reported under consideration.

**Denver, Colo.*—John W. Towle, of Omaha, Neb., it is stated, has received the contract to construct a bridge across Cherry Creek at Larimer St. at $21,000.

Jacksonville, Fla.—Bids will be received until July 5 by the Bd. Co. Comrs. (F. J. Hyde, Chmn.) for constructing 2 steel bridges over Little and Big Fish Weir Creeks on the new Orange Park Road. Roland Woodward, Engr., Bd. Trade Bldg.

**Lockport, Ill.*—Roemheld & Gallery, of Chicago, it is stated, have received the contract to construct the superstructure of 2 single draw bridges, one at 9th St. and the other at 16th St., to be about 320 ft. long and to cost $60,000 each.

Peoria, Ill.—Wm. B. McKinley, of Champaign, is reported interested in a syndicate which proposes constructing a bridge in this city, to cost about $300,000.

Lemont, Ill.—It is reported that the citizens will soon be asked to vote on the question of constructing either a stone-arch bridge at a cost of $20,000 or a steel bridge at a cost of $12,000 across Des Plaines River.

Peoria, Ill.—It is stated that bids will be received until June 28 by the Highway Comrs. for constructing a concrete pier under Upper Free Bridge across Illinois River at Bridge Road; estimated cost, $10,000. Fred. B. Tracy, Co. Clk.

Ft. Wayne, Ind.—It is stated that bids will be received until June 28 by the Co. Comrs. for constructing a 2-span steel bridge, each span 166 ft. long, across Maumee River; also steel bridge across St. Mary's River, one span, 170 ft. O. B. Wiley, Engr., Ft. Wayne; J. L. Smith, Co. Aud.

Martinsville, Ind.—It is reported that bids will be received until July 5 by the Bd. Co. Comrs. for constructing concrete-arch and steel bridges throughout the county. B. R. Johnson, Co. Aud.

**Iowa City, Ia.*—The Iowa Bridge Co., of Des Moines, it is stated has secured the contract to construct the 240-ft. bridge across Iowa River at Hills at $5,995.

Bids received at the same time for constructing a steel bridge at Oxford were rejected, the lowest submitted being from the Iowa Bridge Co. at $3,750 for concrete walk or $3,500 for wood walk. Bids received for a concrete culvert at Oxford were also rejected. Wm. Horrabin, of Iowa City, submitted the lowest bid at $5,500.

Lawrence, Kan.—Bids will be received until July 3 by F. D. Brooks, City Clk., for stone-arched culverts on Mississippi and Winthrop Sts.; about 3,500 cu. ft. masonry.

Drury, Kan.—Bids will be received until July 10 by the Bd. Co. Comrs. at Wellington for furnishing materials and constructing a steel bridge over Chikaskia River at Drury, to have 3 spans 80 ft. each, to rest upon steel cylinders filled with concrete. C. A. MacDonald, Co. Clk.

Pikeville, Ky.—Bids will be received until July 6 by the Bd. Co. Bridge Comrs. for a concrete substructure and steel superstructure, 150-ft. span c. to c., 16-ft. clear roadway, capacity 100 lb. John McDyer, Engr., Cattlesburg. Address Judge W. O. B. Ratcliff, Pikesville.

Lebanon, Ky.—The Co. Comrs., it is stated, are considering the building of a bridge across the Rolling Fork in the west end of the county. The citizens have contributed $2,500 and ask $1,500 from the county.

Pittsfield, Mass.—It is stated that an agreement has been reached between the Boston & Albany R. R. and the city officials whereby a bridge having a 69-ft. span and 32-ft. roadway is to be constructed at 2d St.

Haverhill, Mass.—It is stated that all bids received by the Co. Comrs. at Salem on June 10 for constructing the substructure, superstructure and approaches of a bridge across the Merrimac River between Haverhill and Bradford have been rejected, and it is probable that new plans will be prepared and as soon as approved by the War Dept. new bids will be asked.

**Alpena, Mich.*—P. S. & I. G. Meagher, of Bay City, it is stated, have secured the contract to construct a concrete and iron bridge here, at a cost of about $8,000.

**Mosspoint, Miss.*—The Virginia Bridge & Iron Co., of Roanoke, Va., it is stated, has received the contract to construct a steel bridge 424 ft. long, draw 201 ft. long, across Escatawpa River at Elder's Ferry.

Red Lodge, Mont.—It is stated that the Northern Pacific Ry. bridge across Dry Creek has been destroyed by a cloudburst and will have to be replaced with an entire new structure. E. J. Pearson, Ch. Engr., St. Paul, Minn.

Paterson, N. J.—It is stated that bids will be received until June 29 by the Bd. of Freeholders of Bergen and Passaic Counties at Paterson for completing the 3-span plate girder bridge across Passaic River, estimated to cost $10,000. Fred. Beggs, Chmn., Paterson.

Trenton, N. J.—Bids will be received until June 27 by the Bd. Chosen Freeholders (D. L. Cook, Dir.) for furnishing materials and constructing 2 combination steel and concrete bridges, one over Five-Mile Run, crossing Brunswick Pike, Township of Laurence, and the other over stream crossing Brunswick Pike, Township of Laurence. Frank J. Eppele, Co. Engr.

Minot, N. D.—The Bd. Co. Comrs. will receive bids until July 3 for constructing a steel drawbridge over Des Lacs Lake. J. W. Fabrick, Co. Aud.

Cleveland, O.—The Co. Comrs., it is stated, have been asked to contribute $25,000 toward the construction of a viaduct connecting Fleet St., Harvard St. and Washington Park. The city is to pay $40,000 toward the construction and the property owners $7,000.

The question of issuing $2,000,000 bonds for the construction of a high level bridge, it is stated, is to be submitted to a vote of the people.

The question of constructing a new viaduct to replace the Leonard and Joyce Ave. viaduct is reported under consideration; probable cost, $75,000.

Lima, O.—Bids will be received by the Bd. Co. Comrs. until June 29 for constructing a high truss iron bridge over Riley Creek in place of the Jacob Luginoihl Bridge, Richland Township, to consist of 1 span 104 ft. long, with a clear roadway 16 ft. wide. Geo. Feltz, Co. Aud.

Springfield, O.—See "Business Buildings."

Lorain, O.—It is reported that the Lake Shore Electric Ry. Co. has decided to construct a bridge across Black River at South Lorain. The Co. Comrs., it is reported, will also construct a bridge across Black River at South Lorain for wagon traffic.

Port Clinton, O.—It is reported that bids will be received until July 10 by Co. Comrs. for constructing the substructure of a bridge across Portage River in Harris Township. Henry Pafenbach, Co. Aud.

Portland, Ore.—See "Railroads."

West Chester, Pa.—It is stated that bids will be received until June 27 by the Co. Comrs. for constructing a steel bridge across French Creek.

Reading, Pa.—Bids will be received by H. F. Livingood, Co. Comp., until June 30 for constructing a steel truss superstructure and substructure over Mill Creek. Bids will also be received for bridge over Iron Stone Creek, Douglas Township, to be submitted on a steel superstructure with a concrete roadway and abutments or concrete arch bridge.

**West Newton, Pa.*—The Penn Bridge Co., of Beaver Falls, Pa., it is reported, has received the contract to construct a bridge across Youghiogheny River at West Newton at $67,885.

**Berwick, Pa.*—J. M. Schumaker, Supt. State Bd. Pub. Grounds and Bldgs., Harrisburg, writes that the contract for rebuilding the substructure and superstructure of bridge over Susquehanna River bet. Berwick and Nescopec (bids opened June 13) has been awarded to the York Bridge Co., of York, for $209,500.

New York, N. Y.—The following are the bids opened June 20 by Louis F. Haffen, Pres. Bronx Boro., for constructing approaches to bridges over the N. Y. Central & Hudson River R. R. and the New York and Putnam R. R., at Depot Pl. and W. 177th St.: (*a*) Troy Public Works Co., Utica; (*b*) John J. Hopper, 215 W. 125th St.. (*c*) J. C. Rodgers, 1909 Amsterdam Ave.; (*d*) Kelly & Kelly, 45 E. 42d St.:

	a	*b*	*c*	*d*
Removal and disposal of old bulkheads, piles, etc	$1000.00	$1500.00	$1000.00	..
6,200 cu. yds. excav.	.40	1.50	.50	.60
3,000 lin. ft. bearing piles	.25	.35	.30	.25
30,500 cu. yds. fill. and back fill	.50	.35	.30	.37
1,200 cu. yds. rock fill	1.50	1.00	1.00	.75
2 standard receiving-basins	70.00	200.00	150.00	150.00
3 inlets	70.00	75.00	100.00	50.00
130 lin. ft. vitr. stoneware pipe, 12 in. diam	1.00	1.20	2.00	.80
100 lin ft. vit. stoneware pipe, 8 in. diam	1.00	1.00	1.00	.50
1,950 cu. yds. dry rubble	3.00	2.50	2.50	1.60
400 cu. yds. Class "A" concrete	9.00	10.00	10.00	8.00
9,000 cu. yds. Class "B" concrete	5.60	7.00	6.00	4.00
10 cu. yds. Class "C" concrete	20.00	25.00	20.00	20.00
100 additional barrels Portland cement	1.50	2.00	3.00	1.60
110 sq. yds. waterproofing	1.00	.80	1.00	.50
40 M. ft. lumber	50.00	45.00	40.00	35.00
3,400 lin. ft. new curb	.80	.80	.90	1.70
16,800 sq. ft. new flag	.25	.30	.25	.25
1,000 sq ft. new bridgestone	.60	.70	.60	.60
96 cu. ft. bluestone steps and landings	1.00	1.50	2.00	3.00
4,250 sq. yds. granite block pavt	2.30	2.75	2.40	1.80
560 sq. yds. asphalt block pavt	2.50	2.50	2.00	3.00
4,000 sq. yds. macadam pavt	1.00	1.50	1.35	1.17
278,000 lbs. iron and steel	.045	.05	.04	.051
19,000 lbs. reinforcing bars	.03	.03	.03	.06
3,800 sq. ft. woven wire fabric	.05	.05	.10	.05
2,020 lin. ft. ornamental railing	2.00	3.25	2.00	3.30
400 lin. ft. gas-pipe railing	2.00	1.25	1.00	1.40
150 lin. ft. vitr. stoneware pipe, 15 in. diam	1.00	1.50	2.50	1.00
Total	$125,221	$148,460	$123.052	$109,156

**Items marked thus give the names of parties awarded contracts.*

Philadelphia, Pa.—An ordinance has been passed by the Select Council providing for the construction of the following bridges: At Allen's Lane, over the Wissahickon, $30,000; 25th St. bridge, over the Connecting R. R., $65,000; Front St. bridge, over the Connecting R. R., $45,000; Mount Pleasant bridge at Gorgas and Phil-Ellena St., $70,000; Walnut Lane, over the Philadelphia & Reading Ry., $110,000; Sedgley Ave., over the Richmond branch of the Reading, $40,000; west approach to the Spring Garden St. bridge, $100,000.

Ebensburg, Pa.—Bids will be received until June 27 by the Bd. Co. Comrs. (Benj. Jones, Chmn.) for constructing a low-truss steel bridge over Blacklick Creek at Twin Rocks, to be 75 ft. long, with 12-ft. roadway.

Spartanburg, S. C.—It is stated that bids will be received until July 5 by the Co. Comrs. for constructing 2 bridges, one over South Pacole River near Campobello and the other over Lawson's Fork. F. C. West, Co. Clk.

**Knoxville, Tenn.*—The Oliver Co., of Knoxville, is stated to have secured the contract for constructing the reinforced concrete bridge for the Louisville & Nashville Ry. Co. on Clinch Ave.; cost reported to be about $80,000.

Beaumont, Tex.—It is stated that the Southern Pacific R. R. (Wm. Hood, Ch. Engr., San Francisco, Cal.) intends constructing a viaduct across its yards in this city, to cost about $50,000.

Ogden, Utah.—See "Railroads."

Pasco, Wash.—It is reported that McCreary & Willard, of Spokane, submitted the lowest bid for constructing the steel bridge for the Northern Pacific R. R. in this city. It is to consist of 9 spans, each 250 ft. in length.

Bridgeport, W. Va.—It is stated that an agreement has been reached between the Baltimore & Ohio R. R. (D. D. Carothers, Ch. Engr., Baltimore, Md.) and the city officials whereby the construction of a bridge across the C., L. & W. tracks and the creek connecting Kirkwood and W. Main St. is assured; probable cost, $10,000.

Racine, Wis.—The following are the bids opened June 17 for constructing a bridge at Main St. (P. H. Connolly, City Engr.): Milwaukee Bridge Co., Milwaukee, $104,000; Edward Gillen, Racine, $103,420, and Jackson & Corbitt, Chicago, Ill., $123,016.

Milwaukee, Wis.—The Mayor has recommended to the Council that the offer of the Milwaukee road to contribute $112,000 toward the building of the 6th St. viaduct be accepted.

Johnsonville, Wis.—It is stated that the Town Bd. has decided to replace the bridge which was destroyed by the flood with a new structure to cost $3,000.

Casper, Wyo.—Bids will be received until June 29 by the Dept. of the Interior, U. S. Geological Survey, Reclamation Service, Washington, D. C. (E. A. Hitchcock, Secy.), for constructing a pile bridge about 350 ft. long over the North Platte River about 25 miles southwest of Casper. Chas. E. Wells, Constr. Engr., Reclamation Service, Casper.

Crysler, Ont.—Bids will be received until June 29 by J. A. Cockburn, Township Clk., for constructing concrete piers and building approaches for bridges across the Payne River. W. H. Mazwood, Engr., Cornwall.

Owen Sound, Ont.—Bids will be received until July 14 by W. H. McClarty, Chmn. Bd. of Wks. for constructing bridges as advertised in The Engineering Record.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Hot Springs, Ark.—The City Council is reported to be considering the paving of Central Ave.

Waterbury, Conn.—The Bd. of Pub. Wks., it is stated, has rejected all bids received recently for paving Grand St. and will readvertise, receiving bids on both wood and bitulithic pavements.

Hartford, Conn.—The Senate has passed a bill appropriating $561,000 for work upon the state highways for the next 2 years.

Morris, Conn.—Bids will be received until June 30 by the Bd. Selectmen, for grading and constructing a section or road; Geo. H. Johnson, 1st Selectmen, East Morris.

Farmington, Conn.—Bids will be received until June 30 by the Bd. Selectmen (Chas. S. Bill, Chmn.) for grading, macadamizing or telfording a section of road in this town. A. R. Wadsworth, Engr., Main St.

Washington, D. C.—Bids are wanted July 20 for furnishing and delivering about 7,800 tons broken stone for constructing roadways in Potomac Park, as advertised in The Engineering Record.

Jacksonville, Fla.—The City Engr. has been authorized to prepare estimates of the cost of paving with brick on Gilmore St. from Riverside Ave. to St. Johns River.

Chicago, Ill.—The Bd. of Local Improv., it is stated, has authorized the paving of Union Ave. from W. 41st St. to Garfield Boule. with asphalt, at a cost of about $125,000, and that bids will soon be asked.

The Bd. of Local Improv. also authorized the paving of numerous other streets at an expenditure of $335,000. Some of the streets to be improved are North Spaulding Ave. from West North Ave. to Bloomingdale Road, brick, $34,000; 41st St., bet. Grand Boule. and Cottage Grove Ave., macadam, $27,000; Clybourn Ave. from Diversey Boule. to North Western Ave., asphalt, $34,500, and Ontario St. bet. Wells and Kingsbury Sts., asphalt, $21,500.

It is stated that bids will be received until June 27 by the West Chicago Park Comrs., Union Park (Fred. A. Bangs, Pres.), for replacing timber floor and block paving and plank chord cover for central roadway of Ogden Ave. viaduct at Campbell Ave.

Springfield, Ill.—The Blake Asphalt Co., of Cincinnati, O., it is reported, submitted the only bid for paving on W. Grand Ave. at $1.79 per sq. yd. for paving and 55 cts. per lin. ft. for cement curb and gutter.

Crawfordsville, Ind.—It is reported that bids will be received until June 29 by Henry B. Hulett, City Clk., for constructing cement sidewalks in portions of Jefferson, Beach and Mill Sts., and Wabash Ave.; also paving a portion of Grant Ave. with vitr. brick.

Knox, Ind.—It is reported that bids are wanted until July 5 for constructing about 117,068 ft. roads throughout the county. Lee M. Ransbottom, Co. Aud.

Kokomo, Ind.—It is reported that $9,800 gravel road improvements bonds have been sold.

**Hartford City, Ind.*—Wm. Harley, City Engr., writes that J. P. Knight & Co., of Greenfield, have secured the contract for paving Jefferson St. with vitr. brick (bids opened June 1) for $23,583, and Nolan & Slattery, of Crawfordsville, the contract for brick paving (bids opened June 8) for $14,033.

Vernon, Ind.—Bids will be received until July 3 by the Bd. Co. Comrs. (Phineas B. Ewan, Chmn.) for constructing about 2 miles spike road in Spencer Township.

Logansport, Ind.—It is stated that bids are wanted July 5 by the Co. Comrs. for constructing a gravel road in Jackson Township. O. C. Gard, Co. Aud.

Greensburg, Ind.—It is stated that bids will be received by the Co. Comrs. until July 3 for constructing 9,262 ft. of macadamized road in Sand Creek Township; also 31 miles of macadamized roads in Adams and Clinton townships. Frank E. Ryan, Co. Aud.

Paoli, Ind.—It is stated that bids will be received until July 5 by the Co. Comrs. for constructing 3 miles of gravel or macadamized roads. Alvin B. Ham, Co. Aud.

Des Moines, Ia.—Bids will be received until July 7 by the Bd. Pub. Wks. (W. W. Wise, Chmn.) for paving W. Walnut St. with sheet asphalt, in all about 15,530 sq. yd.; estimated cost, $30,095.

Osceola, Ia.—The City of Osceola will build this year between 20,000 and 25,000 ft. of cement sidewalks and would like to correspond with cement men, as advertised in The Engineering Record.

Clarinda, Ia.—Bids will be received until July 7 by the City Clk. for constructing approximately 10,380 sq. yd. of brick paving and 6,955 lin. ft. curbing, as advertised in The Engineering Record.

Lawrence, Kan.—Bids will be received until July 3 by F. D. Brooks, City Clk., for grading, curbing and paving a portion of Elliott St.; approximate quantities, 13,500 sq. yd. macadam, 8 in. deep, and 5,000 lin. ft. limestone or concrete curbing.

Topeka, Kan.—Jas F. McCabe, City Engr., has been instructed by the Mayor and Council to prepare estimate ot cost of repairing (by resurfacing) the asphalt pavement on Kansas Ave. from 1st to 10th Ave., about 40,000 sq. yd.

The City Council has been petitioned to pave with brick on a portion of W. 10th and Western Aves.

Louisville, Ky.—The Bd. of Pub. Wks., it is stated, will soon ask bids for paving Market St. from 31st to 35th St.

**Rockville, Md.*—R. G. Hilton, Clk., Co. Comrs., writes that the contract for constructing and macadamizing about 1 mile of highway (bids opened June 2) has been awarded to Jas. M. Mount, of Washington Grove, Md.; total bid, $4,300.

Towson, Md.—Bids will be received until June 29 by the Bd. Co. Road Comrs. for grading and macadamizing about 1 mile of road between Garrison and Stevenson's Station. H. G. Shirley, Road Engr.

**Hagerstown, Md.*—John Clarkson, of Hagerstown, has secured the contract to build 2 miles of the turnpike from Conocicheahue, at a cost of about $7,000.

**Towson, Md.*—H. G. Shirley, Co. Roads Engr., writes that the contract for grading and macadamizing about 2 miles of Walkers Ave (bids opened June 8) has been awarded to Thos. A. Martin & Son, of Dickeysville for $7,878.

**Falmouth, Mass.*—Chas. Thomas, of Middleboro, is stated to have secured the contract for building two sections of highway and resurfacing another, at a total of about $9,649.

**Boston, Mass.*—The Bd. of State Highway Comrs., it is reported, awarded the contract to build 4,200 ft. of highway in Tewksbury to F. E. Ellis, of Mélrose, at $5,384, and the contract to build 2,100 ft. in Chester to N. L. Camarco, of Lee, at $3,446.

Worcester, Mass.—The Common Council has adopted the order appropriating $30,000 for permanent street improvements.

Lynn, Mass.—Bids will be received until June 29 by the Bd. Pub. Wks. (Chas. W. Gay, Chmn.) for building to sub-grade a road between Pleasant and Commercial Sts., the work requiring approximately: stone embankment, 4,500 cu. yds.; earth embankment, 45,000 cu. yds.; rip-rap, 1,400 sq. yds., and concrete in culvert, 65 cu. yds.

**Manistee, Mich.*—E. W. Muenscher, Engr., Bd. County Road Comrs., writes that the contract for clearing and grading Sections 8 and 9 of the Onekama branch of the Manistee County Road 2¼ miles long, including 27,000 cu. yd. earthwork and 1¼ miles of clearing, has been awarded to Schneider & Olsen for $4,990.

Lansing, Mich.—H. A. Collar, City Engr., has been authorized to prepare plans for paving Ottawa St. from Washington Ave. to Sycamore St., a distance of about ½ mile.

Bay City, Mich.—The City Engineer is preparing estimates for paving with bitulithic macadam the approaches of the Michigan Central viaduct, and it is stated that bids will probably soon be asked.

The paving of Garfield Ave. and Bway is reported under consideration.

Detroit, Mich.—The following are reported to be the bids received June 6 by Comr. Maybury for repaving the Belle Isle bridge: Jas. Hanley, 40 Fort W. St., $34,647 for creotone; Russell & Jennison, $41,147 for creoline, and Lannane Bros., $35,900 according to specifications.

*Hetherington & Berner, of Indianapolis, Ind., it is stated, have received the contract for the portable asphalt plant at $10,750.

Winona, Minn.—The City Council is said to be considering the paving of Main St. from Bway to Mark St.

**Grenada, Miss.*—C. B. Bolton, City Engr., writes that the following are the bids recently received for about 50,000 sq. ft. granolithic sidewalks (price given per sq. ft.): Walsh & Hamilton, Jackson, 18⅓ cts.; Rudolf S. Bloome Co., Chicago, Ill., 16.9 cts.; Miller Paving Co., Memphis, Tenn., 17 cts.; Mississippi Paving Co., 15 cts.; K. C. Thompson & Co., Greenville, Miss., 14⅞ cts., and Sands, Lawson & Key, Norfolk, Va., 13 4-9 cts.

Holly Springs, Miss.—It is stated that $10,000 road improvement bonds are to be issued.

Chillicothe, Mo.—Bids will be received by the Bd. of Pub. Service, July 1, for about 22,000 sq. yds. brick paving and 7,000 ft. 5-in. curb. H. M. Redd, City Engr.

Anaconda, Mont.—The paving of Main St. from Cooper to Woodland St. is reported under consideration.

Trenton, N. J.—Bids will be received until July 3 by the Park Comrs. for constructing a macadam road in Cadwallader Park.

**Jersey City, N. J.*—The Barber Asphalt Paving Co., N. Y. City, it is stated, has secured the contract to pave with asphalt on Newark Ave. from Warren to Brunswick St. at $2.46 per sq. yd.; total cost about $36,000.

Jersey City, N. J.—See "Railroads."

**Morristown, N. J.*—The following are the bids opened on June 19 by the Bd. of Chosen Freeholders for macadamizing the following roads: (*a*) Morris Plains and Parsippany Road; (*b*) Montville and Mountain View Road; (*c*) Green Village and Madison Road: Smith & Grupelli, *a* $16,783; Herbert Solmon, *a* $14,329. J. B. Salmon, *a* $13,473, *b* $14,347 (awarded contract), *c* $10,340; Dickerson & Gill, *a* $13,045 (awarded contract), *c* $9,498 (awarded contract); Preekness Stone Crushing Co. and Peter Bailey, *b* (2 bids) $18,567 and $15,804; W. & A. Bunn *b* $15,644; Hilbert & Hinds, *c* $10,259.

**Newark, N. J.*—The Newark Paving Co., 800 Broad St., it is stated, secured the contracts to pave with brick on portions of Mt. Prospect Ave. at $14,665, Alpine St. at $14,133 and Hunterdon St. at $30,028.

The Bd. of Wks. has published notices of intention to pave with either brick or granite block on New St. bet. Arch and Lock and Wilsey and 2d Sts. and on Pine St. bet. Williams and Court Sts.

Perth Amboy, N. J.—It is stated that bids will be received until July 3 for paving State St. with either vitrified shale paving brick or Bermudez or Venezuela asphalt; approximate quantities, 320 lin. ft. 4x16 curb set in concrete, 1,000 cu. yd. earth excav., and 2,370 sq. yd. paving surface. Wm. Fullerton, Street Comr.

Paterson, N. J.—Bids will be received until June 30 by the Road Com., Bd. Chosen Freeholders (David Wickham, Chmn.), for repairing and macadamizing roads throughout the county.

**Freehold, N. J.* — W. C. Shanley, of Newark, it is stated, has secured the contract to build a stone road from Freehold to Colt's Neck at $22,874.

Bids will be received until July 12 (readvertisement) by the Bd. Chosen Freeholders at Freehold (John Guire, Dir.) for building the first section of the Allentown and New Egypt stone road, in all about 3½ miles.

New York, N. Y.—Bids will be received until June 28 by John F. Ahearn, Boro. Pres., for regulating, grading, curbing, paving and repaving portions of numerous streets. Engineer's estimate: 119,920 sq. yds. asphalt pavt., including binder course; 67,600 sq. yd. wood blk. pavt.; 4,000 sq. yd. asphalt blk. pavt.; 4,990 sq. yd. new granite blk. pavt., including sand bed laid with paving cement joints; 1,855 sq. yd. Belgian blk. pavt., furnished and laid; 87,320 lin. ft. new bluestone curb, furnished and set; 4,465 lin. ft. new curb, furnished and set; 12,577 cu. yd. concrete, including mortar bed; 14,260 sq. ft. new flags, furnished and laid; 11,304 cu. yd. rock excav., etc.; also for furnishing and delivering 8,000 cu. yd. sand, furnishing and delivering 1,800 cu. yd. trap-rock broken stone and 1,800 cu. yd. trap-rock screenings.

The Bd. of Aldermen on June 20 voted $90,000 for repairs to asphalt paving.

Brooklyn, N. Y.—The following are the bids opened on June 14 by Martin W. Littleton, Pres. Brooklyn Boro.: (Bidders of Brooklyn, unless otherwise mentioned):

*Regulating and laying cement sidewalks on 74th St., from 2d to 7th Aves.: Hickey McFarland Co., 2d Ave. and 6th St., $19,688; Norton & Gorman, 303 Douglass St., $22,981; Ficklin & Stobaugh, 76 Pine St., New York, $20,347; N. Schneider's Sons, 144 21st St., $19,676 (awarded contract); Uvalde Co., 1 Bway, New York, $19,823; Troy Pub. Wks. Co., Utica, N. Y., $23,627; Mangieri Co., 2243 1st Ave., New York, $19,752; Chapman & Ryan, 156 3d St., $22,348. The detail bid of N. Schneiders Son, the successful bidders, is as follows: 1,690 sq. yds. brick gutter on concrete found., $2.25; 7,610 lin. ft. new curb, in concrete, $1.10; 9,240 cu. yds. earth excav., 20 cts., and 37,700 sq. ft. cement sidewalks, 15 cts.

*For regulating and repaving with granite on a concrete foundation Kent Ave., from Hewes St. to Clymer St.: George & Farrell, 576 Douglass St., $16,783; Chapman & Ryan, 156 3d St., $18,120; O'Grady Bros., 72 N. 8th St., $18,325; Cunningham & Kearns, 434 E. 91st St., New York, $16,088 (awarded contract); Norton & Gorman, 303 Douglass St., $17,017. The detail bid of the successful bidders, Cunningham & Kearns, is as follows: 4,100 sq. yds. granite block with tar and gravel joints, $2,39; 850 cu .yds. concrete, $3.90; 3,200 lin ft. new curb, 77 cts., and 760 sq. ft. new granite bridgestones, 65 cts.

*The Uvalde Co., 1 Bway, New York, secured the contract for regulating and laying cement sidewalks on Blake Ave., from Hopkinson Ave. to Howard Ave., (bids opened June 14) at the following bid: 3,424 lin. ft. new curb set in concrete, $1.02; 4,197 cu. yds. earth excav., 30 cts.; 17,684 cu. yds. earth fill, 30 cts.. 15,260 sq. ft. cement sidewalks, 14 cts.; total, $12,193. The other bidders were: Norton & Gorman, 303 Douglass St., $21,854; Dan'l Douglass, 122 Logan St., $13,643; Dan'l F. McCarty, 350 Rochester Ave., $15,657; Frank J. Gallagher, 574 Park Pl., $20,301; Frank M. Walsh, 397 Hamilton Ave., $15,180, and Troy Pub. Wks. Co., Utica, $14.579.

Bids will be received until July 5 by Martin W. Littleton, Boro. Pres., for regulating, grading, curbing, paving and laying sidewalks on portions of several streets. Engineer's estimate: 11,880 sq. yds. asphalt pavt.; 23,015 sq. ft. cement sidewalks; 11,012 lin. ft. new curb, to be set in concrete; 2,736 lin. ft. steel-nosed concrete curb; 3,350 ft. new bluestone bridging, etc.

Brooklyn, N. Y.—The following are the bids opened by the Comrs. of Parks, N. Y. City, June 15 for furnishing and delivering 5,590 cu. yd. fine and screened gravel in parks in Brooklyn Boro. (price given per cu. yd.): Brown & Fleming Contr. Co., $2.15; Isaac Harris, $2.15, and Norton & Gorman Contr. Co., $2.90.

Frank J. Gallagher, 574 Park Pl., Brooklyn, bid same time and place for furnishing material and building roadway and walks in rear of Institution of Arts and Sciences. Brooklyn, a total of $19,880, bidding for 6,555 sq. ft. granolithic walks, 17½ cts.; 1,210 lin. ft. curb, 80 cts.; 3,000 cu. yd. excav., 30 cts., and 1,147 sq. yd. macadam, 79 cts.

**Items marked thus give the names of parties awarded contracts.*

**Brooklyn, N. Y.*—The following are the bids opened June 14 by Martin W. Littleton, Pres. Brooklyn Boro. for regulating and repaving with asphalt block on a concrete foundation, Bway. from Havemeyer St. to Lafayette Ave.: (*a*) Barber Asphalt Paving Co., New York; (*b*) Hastings Pavt. Co., New York; (*c*) Chas. Cranford, 44 Court st.; (*d*) Interstate Paving Co., 44 Court St. (awarded contract); (*e*) Kelly Asphalt Blk. Co., Brooklyn:

	a	*b*	*c*	*d*	*e*
34,410 sq. yds. adjacent pavement	$1.91	$1.66	$1.57	$1.20	$1.49
300 sq. yds. adjacent pavement	.30	.30	.30	.30	.25
5,170 cu. yds. concrete	4.20	4.80	4.25	4.00	4.50
13,660 lin. ft. new curb	.81	.82	.85	.80	.80
3,720 lin. ft. old curb. reset	.30	.30	.35	.30	.32
81 noiseless covers and heads	14.00	15.00	15.00	15.00	15.00
	$100,842	$95,558	$90,214	$75,321	$87,944

**Rochester, N. Y.*—Brayer & Albraugh, 27 Main E. St., it is stated, have secured the contract to pave on Hudson Ave. with Metropolitan brick, at $63,355.

**Albany, N. Y.*—M. F. Dollard, 86 State St., it is stated, has secured the contract to pave with granite block on Liberty St. at $2.28 per sq. yd.; total, $8,668.

**Elmira, N. Y.*—McCann & Handrahan, it is stated, have received the contract to pave with brick on concrete between the tracks of the Elmira Water, Light & R. R. Co. on Maple Ave. and Clinton St. at $2.13 per yd.

**Schenectady, N. Y.*—Kellam & Shafer, it is stated, have secured the contract to pave with sheet asphalt on Elmer Ave. at $2.15 per sq. yd. and on Jay St. at $2.19 per sq. yd.

Newark, N. Y.—Bids are wanted June 26 for paving with Metropolitan block, Corning brick or blocks or brick, of equal quality, as advertised in The Engineering Record.

**Oxford, N. Y.*—The detail bid of Frank Pidgeon, of Saugerties, who has secured the contract for paving at Oxford (bids opened June 1) is as follows: 6,700 sq. yd. macadam, $1.03; 1,100 cu. yd. broken stone, $2.57; 250 lin. ft. 8-in. drain, 30 cts., and 1,000 lin. ft. 5-in. farm drain tile, 20 cts.; total, $10,003. The other bids received were from Daniel J. Conroy, Oneida, $11,965, and C. H. Qurean, of Baldwinsville, $11,065.

**Batavia, N. Y.*—The City Clk. writes that John Mahoney, of Jamestown, has secured the contract for paving, to cost about $35,000.

Buffalo, N. Y.—The Barber Asphalt Paving Co., 880 Ellicott Sq., it is stated, bid $6,676 for paving on Harmonia St., $3,238 for paving on Alabama St., and $9,103 for paving on Stanislaus St.

The repaving of a portion of Gilbert Ave. with brick at a cost of $7,408 is reported under consideration. (bids opened June 5) for $34,075.

Peekskill, N. Y.—Bids will be received until July 11 by the Bd. Village Trus. (Albert E. Cruger, Clk.) for paving with hard-burned paving brick on portions of S. Division, Brown and Main Sts., requiring in all about 4,140 sq. yd.

Ashland, O.—It is reported that bids will be received until July 11 by the Village Clk. for furnishing materials, grading, curbing and paving a portion of Pleasant Ave.

Toledo, O.—Bids will be received until June 29 by the Bd. Pub. Service (Harry S. Jones, Secy.) for grading, curbing and paving an alley with either vitr. asphalt or creosoted wood blocks, sheet asphalt or Medina block stone; also repaving a portion of Summit and Galena Sts. with either vitr., asphalt or creosoted wood blocks, sheet asphalt, bitulithic pavt., or other bituminous macadam.

**Cincinnati, O.*—The following are the bids opened June 15 by the Bd. of Pub. Service for paving E. 5th St. with asphalt and on Prospect Pl. with bitulithic pavement: The Kirchner Constr. Co., Cincinnati, $22,315; Warren Bros. Co., Mercantile Bldg., $22,326, and Henkel & Sullivan, Mercantile Bldg., $22,080 (awarded contract).

E. S. Gleason, it is stated, bid $9,201 for paving on Conroy St., from Baymiller St. to Freeman Ave.

Henkel & Sullivan, Bodmann Bldg., it is stated, submitted the lowest bid for bitulithic paving on Ringgold St. from Highland Ave. to Josephine St. at $2.87 per sq. yd.; total, $15,063.

Cleveland, O.—Bids will be received until June 27 by the Bd. Pub. Service (A. R. Callow, Secy.) for grading, curbing and paving with brick a portion of Rhodes Ave.; also with asphalt a portion of Lake Ave. and repaving with common Medina stone a portion of Muirson St.

Youngstown, O.—An ordinance has passed the City Council authorizing the paving of W. Federal St.

Zanesville, O.—Petit & Abele submitted the lowest bid for paving 2,345 sq. yd. on Kelly St. at $3,223 for tar filling, $2,918 for sand filling and $3,105 for cement filling.

Port Clinton, O.—Bids will be received until July 10 by W. H. Cleaver, Village Clk., for $5,200 bonds for paving a portion of Madison St.

Cleveland Heights, O.—It is stated that bids will be received until July 11 by Wm. G. Phare, Village Clk., 402 American Trust Bldg., Cleveland, for grading Mayfield Road.

Woodville, O.—It is stated that bids will be received until July 3 for paving Maumee Pike, requiring about 12,580 sq. yd. J. C. Overmyer, Engr., Fremont, O.

Dayton, O.—It is stated that bids will be received until June 27 by the Bd. Pub. Service (Wm. F. Miller, Clk.) for repairing about 8,000 sq. yd. of asphalt streets; also for constructing cement sidewalks, stone flagging, curb and boulder gutters on Warner Ave. F. M. Turner, City Engr.

Xenia, O.—Bids will be received until July 27 by the Bd. Pub. Service for paving Market St. with brick, asphalt or bitulithic, in all about 17,430 sq. yd., as advertised in The Engineering Record.

Philadelphia, Pa.—An ordinance has been passed in the Common Council authorizing the paving of a number of streets with asphalt.

*The M. McManus Constr. Co., 414 Wood St., it is stated, has received the contract to pave at the Elwood School at $5,900. and at the Alcorn School at $1,163.

Shamokin, Pa.—The residents have petitioned the Boro. Council to pave 6th and Arch Sts.

**Tamaqua, Pa.*—W. F. Leopold, Boro. Secy., writes that the contract for paving Mauch Chunck St., 2,500 sq. yds. (bids opened June 6), has been awarded to the Coryell Constr. Co., of Williamsport, for $5,775.

Allegheny, Pa.—See "Sewerage and Sewage Disposal."

**Erie, Pa.*—John McCormick & Son, 645 W. 10th St., it is reported, has received the contract to pave with brick on Ash St., from 6th to 3d Sts., at $1.34

York, Pa.—Bids will be received until July 8 by the State Highway Dept. (Jos. W. Hunter, Comr.), Harrisburg, for constructing 6,140 ft. road, extending from the township line of Springarden to San Domingo, in Springetsbury Township, York County.

Tiverton, R. I.—Bids will be received until July 1 by the Town Council for constructing 1 mile of stone road on the Stafford Road. E. M. Corbett, Engr., 70 Bedford St., Fall River, Mass.

Providence, R. I.—Bids will be received June 28 by the State Bd. Pub. Roads (John H. Edwards, Chmn.) for constructing a section of state highway in the town of Warwick, about 5,280 ft., and in the town of Portsmouth about 2,640 ft.

Ft. Moultrie, S. C.—Bids will be received until June 28 by F. W. Cole, Q. M., U. S. A., for constructing roads and walks here.

Knoxville, Tenn.—The City Council on June 16 passed on first reading the ordinance providing for the paving of about 35,000 sq. yd. with brick and asphalt, to include Asylum St. and Church and 5th Aves.

Dallas, Tex.—The paving of St. Ervay St., probably with asphalt, is reported under consideration.

Salt Lake City, Utah.—The City Council is reported to have decided to pave State St. from N. Temple St. to the State Capitol grounds.

Petersburg, Va.—See "Water."

Monroe, Wis.—It is stated that bids will be received until July 7 by W. T. Saucerman, Deputy City Clk., for grading and constructing 7½ blocks of macadam streets with cement curbing.

Honolulu, H. I.—Bids are wanted July 20 for dredging in Honolulu Harbor, Hawaii, as advertised in The Engineering Record.

POWER PLANTS. GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Ensley, Ala.—The Mayor and Bd. of Aldermen are stated to have on June 15 authorized the Lighting Com. to investigate the question of constructing an electric light plant, procure plans and specifications and report back to Council July 6.

Wyoming, Del.—Alex. Daly, representing Philadelphia, Pa., capitalists, is reported to have presented to the citizens of Wyoming and Camden, Del., a proposition to install a water and light plant to supply both towns.

Washington, D. C.—Bids will be received until July 5 at the Bureau Supplies and Accounts, Washington, for furnishing at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C.; Annapolis, Md., and Norfolk, Va., a quantity of naval supplies as follows: Electrical supplies, incandescent lamps, wattmeters, electrical wire; conduit; Portland cement; Plumb Island sand; angles, plates; pipe and fittings, corks, etc.; also July 18 at the navy yards, Mare Island, Cal., and Puget Sound, Wash., and the naval training station, San Francisco, Cal., a quantity of naval supplies as follows: Motors, iron, trails, soil pipe and specials, jacks, etc. H. T. B. Harris, Paymaster Gen., U. S. N.

St. Augustine, Fla.—J. D. Lawrence, of Jacksonville, is reported interested in the construction of an electric light plant and street railway in St. Augustine.

Streator, Ill.—The Council is reported to have appropriated $30,000 for the establishment of a municipal lighting plant.

Pana, Ill.—The National Power, Light and Heating Co. is reported organized, with J. N. C. Shumway, of Taylorville, Pres., and Geo. B. Martin, of New York, N. Y., Secy. It is stated that the company will at once commence the construction of a gas plant.

Cayuga, Ind.—The Town Bd. is reported to have ordered plans and will soon let contracts for constructing an electric light plant.

Greenfield, Ind.—The Water and Light Comrs. are reported to be in the market for a 350-h.p. engine and 2 new boilers for the electric light plant.

Ft. Dodge, Ia.—The City Council is reported to have appointed a committee to investigate the construction of a gas and electric light plant, to be owned and operated by the city.

Sumner, Ia.—L. L. Stewart, of Omaha, Neb., is reported to have secured a franchise for an electric light plant.

Creston, Ia.—The City Clk. writes that a franchise for an electric light plant has been granted to a new company, with J. C. Sullivan Pres. and J. W. Reynolds Secy. The company is now arranging to purchase equipment for a plant to cost about $40,000.

Campbellsville, Ky.—J. L. Atkinson, pres. Cambellsville Lighting Co., writes that bids for constructing an electric light plant to cost about $4,000 will be received about Aug. 15. Engineer, B. S. Kincort, Lebanon, Ky.

Shreveport, La.—Mayor Querbes and the Lighting Com. are reported to have decided to recommend that Council enter into a contract with the Shreveport Gas, Electric Light & Power Co. for lighting the city a period of 6 years.

New Orleans, La.—R. S. Stearns, 222 Elmira Ave., New Orleans, writes that the Algiers Ry. & Lighting Co. is to construct a power plant at a cost of $200,000.

Holyoke, Mass.—Plans are reported to have been completed for the new power plant of the Holyoke Water-Power Co. on the west bank of Connecticut River. The plans call for the construction of a new canal, from which water will be conveyed to a power plant generating 7,000 h.p.

Glendale, Mass.—The Monument Mills Co., of Housatonic, is reported to be making plans to develop the water power at Glendale. Barnes & Farnham, of Pittsfield, are making surveys.

Ann Arbor, Mich.—Bids will be received on June 28 by the Lighting Com. of Council at the office of Ross Granger, City Clk., for lighting the streets for a term of 5 years, beginning Dec. 31, 1905, as advertised in The Engineering Record.

Melrose, Minn.—Bids are wanted June 29 for constructing water-works and an electric light plant, to consist of a brick building, steam and pumping plant or gas-producer power plant, generator, pole line and wiring, steel tower and tank, distribution pipe line system and a system of driven wells. F. J. Weisser, City Clk. Engineer, Oscar Claussen, 514 Natl. German-American Bank Bldg., St. Paul.

Helena, Mont.—The Missouri River Power Co. is reported to have decided to build a second dam across Missouri River, to develop electric power, to cost about $1,000,000.

Kearney, N. J.—The following are reported to be the bids opened by the Council June 14 for the construction of an electric light plant:

For Erecting Building—Hedden Iron Co., $19,600; V. J. Hedden & Sons, $18,775; Sandford, Harris Co., $17,950.

Steam Plant of Engines, Boilers, Etc.—Providence Engine Works, $11,200; Ball & Wood Co., $12,816; J. G. Robertson, $5,570; McKensie, Quarrie & Ferguson, $10,995; F. Edwin Burham, $9,876; Mumford Boiler Co., $9,990; A. D. Granger Co., $10,800; Earle C. Cook, $10,251; Lake Erie Boiler Wks., $15,590.

Electrical Equipment in Power Station — Crocker-Wheeler Co., $4,814; Stanley Electrical Mfg. Co., $6,720; E. V. Wingate, $5,450; David C. Seymour, $9,089.

Erecting Chimney—The Keeler Co., $2,000; David C. Seymour, $2,966; F. Edwin Burham, $2,426; A. D. Granger Co., $2,762; Lake Erie Boiler Wks., $3,250.

Furnishing Switchboard, Wires, Poles and Street Equipment—C. E. Hood & Co., $28,076; Electric Motor & Equipment Co., $21,735; Peet, McInerney & Powers, $24,445.

Furnishing Lamps and Carbons — Westinghouse Mfg. Co., $2,900; Adams Electrical Co., $1,656; Stanley Electric Co., $1,382.

New York, N. Y.—Plans have been filed for a 4-story and basement brick and stone power house to be erected at 452 W. 27th St. by the N. Y. Edison Co., 55 Duane St., at a cost of $50,000.

Andover, N. Y.—The Andover Electric Power & Light Co., of Andover, is reported incorporated, with a capital of $10,000, by R. A. Stout, A. B. Richardson and J. H. Backus, all of Andover.

Little Falls, N. Y.—The Hudson River Electric Power Co. is stated to have applied to City Council, through Attorney Rush F. Lewis, for a franchise to construct a transmission line for the distribution of electricity for lighting, heating and power purposes.

Newark, N. Y.—J. L. Rigby, W. L. Mathues and others, all of Philadelphia, Pa., are reported to have purchased the plant of the New Light, Heat & Power Co. H. M. Whitehead, of Newark, will be manager.

New Rochelle, N. Y.—The Northern Westchester Lighting Co. (F. A. Stratton, Pres.) is reported to have consolidated all the lighting companies in Ossining, Croton, Briarcliff Manor and Pleasantville, and will probably make improvements to the plants purchased.

Youngstown, O.—G. T. Prosser, Clk., Bd. Pub. Service, writes that all bids opened on June 19 for constructing an electric light plant for the water works pumping station have been rejected on account of labor and material not being separated, and new bids will be received July 5.

Cambridge Springs, Pa.—The Cambridge Springs Electric Light Co. is reported incorporated, with a capital of $20,000, by A. H. Matteson, Chas. W. Jones and others, all of Cambridge Springs.

Tamaqua, Pa.—The Tamaqua Heat, Light & Power Co. is reported to have purchased a site for a new plant.

Philadelphia, Pa.—Bids will be received by Mordecai T. Endicott, Ch., Bureau Yards and Docks, Navy Dept., Washington, D. C., until July 1 for furnishing, delivering and installing in underground conduits lead-encased, hard-covered, paper-insulated, copper-wire, low-voltage electric lighting and power cables; estimated cost, $22,000.

Reading, Pa.—The Reading Illuminating Co. has petitioned Council for a franchise to erect poles and string wires and furnish light, heat and power.

Rock Hill, S. C.—The Catawba Power Co. (Wm. H. Martin, Jr., of Rock Hill, Secy.) is reported to be making a survey on Wateree, 14 miles below Camden, with a view to constructing a power plant there.

Montrose, S. D.—Donohue & Williams, of Montrose, write that their electric light plant is about completed, but they desire fixture (electric) catalogues.

Lafollette, Tenn.—The Lafollette Water, Light & Telephone Co. is reported organized, with a capital of $150,000, and will begin construction immediately of water works, an electric light plant and telephone system. Directors: W. C. Knight, St. Louis, Mo.; F. A. Joss, Indianapolis, Ind., and T. C. Whalen, Indianapolis, Ind.

Murfreesboro, Tenn.—The City Council is reported to

**Items marked thus give the names of parties awarded contracts.*

have granted the City Gas & Electric Light Co. a franchise and a 10-yr. contract.

Denton, Tex.—The city is reported to have purchased the plant of the Denton Water, Light & Power Co. and will take possession on July 1.

Dallas, Tex.—A charter has been granted to the Dallas Gas Co., of Dallas, with a capital of $1,000,000, to supply Dallas with light, heat and power, etc. Incorporators: Henry R. Wilson and H. A. Kahler, of New York; J. E. Schneider and W. R. Styron, of Dallas, and others.

Chehalis, Wash.—It is reported that Harry West, present owner of the electric light plant, will construct a 400-h.p. plant on Coal Creek, north of town.

Charlestown, W. Va.—See "Electric Railways."

Niagara Falls, Ont.—Jas. N. Patton, of Montreal, Que., is reported to have completed survey for the Niagara-Welland Power Co. to Guelph, and will continue the survey to Preston for a line to Berlin and will run westward to Stratford.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Bids will be received until July 1 by the Mobile Light & R. R. Co. for grubbing, clearing, grading, sewer pipe waterways, masonry and drainage for 2¼ miles of electric car line. Approximate quantities: 13 65/100 acres clearing and grubbing, 8,000 cu. yd. earth, excav., 262 lin. ft. sewer pipe, 12 cu. yd. masonry.

Ft. Smith, Ark.—The directors of the Ft. Smith Light & Traction Co. are stated to have voted at a recent meeting, held in St. Louis, Mo., to issue $100,000 bonds to carry on the improvements of the street car system in this city. W. R. Abbott, of Ft. Smith, is one of the directors.

Los Angeles, Cal.—It is reported that an electric railway, to be known as the San Jacinto-Hemet line, will soon connect San Jacinto, Hemet and Riverside. A San Francisco syndicate is said to be engineering the project, and the necessary right of way is to be furnished by farmers and merchants whose property will thus be improved. H. E. Huntington is thought to be largely interested in the enterprise. The total distance to be covered by the system is 30 miles. It is estimated that the cost of the construction and equipment of the proposed road will amount to about $500,000.

**Danbury, Conn.*—The Danbury & Harlem Traction Co. is reported to have awarded to W. E. Warren, of Mt. Vernon, N. Y., the contract for completing the electric railway from this city to Golden's Bridge, N. Y.

St. Augustine, Fla.—See "Power Plant, Gas and Electricity."

East St. Louis, Ill.—The St. Louis & Northeastern Ry. Co., known as the McKinley Electric System, will make application to Council for a franchise to construct and operate an electric railway along several streets.

Indianapolis, Ind.—The Indianapolis & Western Ry. Co. has petitioned the Bd. of Works for a franchise to enter the city over the lines of the Indianapolis Traction & Terminal Co. The road will parallel the Big Four to Danville, and this part of the road will be in operation by early fall. The intention is to build the road from Danville to Greencastle and from Greencastle to Brazil and ultimately into Terre Haute. The right of way has been obtained and most of the concrete construction is in place.

Corydon, Ind.—The 2 per cent. subsidy tax is reported to have been voted by the property holders of Harrison and Franklin Townships, to aid in the construction of the extension of the Louisville & Southern Indiana Traction Company's line from New Albany to Corydon. The work in Corydon has already been begun by the company on through right of way of the Old Highland line, which extends through the range hills west of New Albanay. An extension is contemplated to French Lick and West Baden.

**Huntington, Ind.*—John Shaffer, Constr. Engr., of the American Eng. Co., of Indianapolis, with a force of men, is stated to have started the final survey of the traction line to be built north from this city through Columbia City to Goshen. Work of construction will follow by the American Eng. Co., which has secured the contract.

**South Bend, Ind.*—The Indiana Ry. Co., which controls largely the Northern Indiana & Southern Michigan interurban and City Traction line situation, is reported to have awarded the contract for the construction of a new branch of the system from South Bend to Laporte to Geo. Townsend, of Indianapolis.

Goshen, Ind.—It is reported that an election for Wayne Township, Noble County, to vote on a subsidy of $20,000 in aid of the Toledo & Chicago Interurban Co., has been set for July 10. The company is to build and equip the line and construct a power house in Kendallville.

Winona, Ind.—The Winona Interurban Ry. Co. is reported to have filed articles of incorporation; capital $500,000. The articles state that the corporation's purpose is to continue the line now in operation between Warsaw and Winona to Goshen and Peru, and ultimately to Ft. Wayne and Logansport. Thomas Kane and other men connected with the Winona Assembly are directors.

Fairfield, Ia.—The business men of this city have asked to join with those of Keosauqua to promote the construction of a connecting interurban road. A delegation of 35 men has been chosen in Keosuqua to confer with a delegation from Fairfield as to the best method of procedure in promoting this enterprise. The proposed line would be about 16 miles in length, passing through a rich agricultural and stock-raising community, much of which is far distant from railroads.

Boone, Ia.—The Boone Suburban Ry. Co. is reported to be considering plans for the construction of an extension from Boone to Stanhope, thence to a point 3 miles west of Homer and to Flugstad and Highview. Connections will be made with the Crooked Creek Ry. Co. at Flugstad and with the Illinois Central at Highview.

Hyattsville, Md.—Engr. Wm. H. Benton, of the Anacostia, Surrattsville & Brandywine Electric Ry., is reported to have completed preliminary surveys beyond Silver Hill to Henson's Branch, and that practically all of the rights of way have been secured. This road begins in Anacostia and leaves the District of Columbia line at Walker's Road. It passes Silver Hill, Camp Springs, Surrattsville, and terminates at Brandywine.

Jackson, Miss.—The Jackson Electric Ry., Light & Power Co. is reported to be considering rebuilding its power plant, adding about 5 miles of railway and new cars, and making other equipment. John Lorenz, Mgr., Jackson.

Oran, Mo.—The Oran Electric R. R. Co., of Oran, is reported incorporated, with a capital of $50,000, to build an electric railway 10 miles in length, fromm Oran to Rockview. Incorporators: M. C. Gresham, Geo. Albert, F. D. Cooksy and others.

Great Falls, Mont.—The Co. Comnrs. are reported to have granted Dr. Ernest Crutcher, of Great Falls, a franchise for the construction of an electric railway here. It is the purpose of Dr. Crutcher to apply for similar franchises in Teton, Fergus, Lewis and Clarke and other counties.

Newark, N. J.—The Public Service Corporation (Thos. N. Carter, Pres.) is stated to have decided to construct an electric road to connect Newark and New York City. The Passaic River will be tunneled, but it has not yet been determined whether to tunnel or bridge Hackensack River. The route through Jersey City will be in part elevated and in part below the grade. Terminal station and office building will be erected in Newark.

New York, N. Y.—The New York & Jersey R. R. Co., as successor of the Hudson Tunnel Co., is stated to have applied for and obtained from the State R. R. Comn. a certificate under the extension granted by the Rapid Transit Comn. on Feb. 2, 1905, for the construction of branch tunnels from Christopher and Greenwich Sts. to 6th Ave. and 33d St. and to 4th Ave. and 9th St.

The Bronx, Yonkers & White Plains Ry. Co. has petitioned the State R. R. Comn. for a franchise for an electric railroad to run from the Bronx to White Plains and Yonkers.

Syracuse, N. Y.—The Syracuse Northern Traction Co. is to be organized soon to construct an electric railroad from North Syracuse through Cicero to Brewerton, on Oneida Lake, and another branch to Bridgeport and Shakleton Point. The purpose is to connect with the line now in course of construction by the Syracuse & South Bay R. R.

Utica, N. Y.—Press reports state that the Hudson River Water Power Co., of Glens Falls, has secured the contract to furnish electric power for the electric lines to be operated along Mohawk Valley in the vicinity of Utica recently acquired by the New York Central R. R. Large turbines will be installed near Utica for reserve power.

Canton, O.—The Canton & Youngstown Ry. Co. proposes to begin work this summer on the line, built largely on its own right of way, and connecting Canton, Youngstown and Akron. The total length of the track is to be 64 miles. J. Royal Snyder, Pres., and L. D. Blanchard, Secy., both of Canton.

Barberton, O.—The Barberton, Wadsworth & Western Ry. is reported to have decided to soon ask bids for grading the portion of its line from Barberton to Wadsworth.

**Philadelphia, Pa.*—Schofield & Co. are reported to have secured the contract for constructing the power house for the Philadelphia Rapid Transit Co. on Beech St. and Fairmont Ave. for about $100,000.

York, Pa.—The York St. Ry. Co. is stated to have decided to extend its line around the southwestern part of the city. It is the purpose of the company to build a subway at the crossing of the Northern Central Ry. 350 ft. long and 25 ft. wide.

Wayne, Pa.—It is reported that the Philadelphia & Western R. R. Co. will adopt the third-rail system for its new line from Philadelphia to this place and Parkesburg. It has been decided to begin at once the erection of a power house near Cobb's Creek. It is understood that the equipment will represent about 15,000 h.p.

Waynesboro, Pa.—It is reported that the Hagerstown Electric Ry. Co., of Hagerstown, Md., proposes extending its line to Greencastle, running out from Hagerstown over the Marsh Pike.

Bangor, Pa.—Town Council has referred to committee an ordinance granting the Northampton Traction Co. the right to extend its tracks through to the terminus of the Monroe & Northampton Trolley line.

Gettysburg, Pa.—At a town meeting the people of Libertytown, Md., are reported to have subscribed $10,000 toward the building of the Washington, LeGore & Gettysburg Electric Ry.

Easton, Pa.—Common Council has passed the ordinance granting the Northampton Traction Co. the right to build a line on Spring Garden and Wood Sts., to connect with the company's tracks on Bushkill St.

Sayre, Pa.—Ordinances are about to be introduced in Council granting franchises to the Athens, Sayre & Waverly Traction Co., and the Waverly, Sayre & Athens Traction Co. The latter company wants to double track Elmer Ave., from Mohawk to Lockhart.

Carrolltown, Pa.—The towns people here are reported to have voted in favor of granting the Northern Cambia St. Ry. Co a franchise for a line through the town.

Reading, Pa.—The United Traction Co. is reported to have decided to build a power plant at Tulpehocken Creek, near Reading. The company will also enlarge its Klapperthal plant.

Nashville, Tenn.—Surveys have been made for the Murfreesboro Pike extension of the Nashville Ry. & Light Co.'s lines. The extension will be laid for about 1¼ miles from the Wharf Ave. car line, and the terminus will be at the Industrial School Lane.

Chattanooga, Tenn.—It is stated that in addition to the construction of the interurban electric railway through Chickamauga Park and Ft. Oglethorpe to Ducktown, S. W. Divine will immediately secure the right of way along the route of the old broad-gauge road, and construct an electric railway up Lookout Mountain.

Charlestown, W. Va.—The Winchester & Washington City Ry. Co. is stated to have purchased from the estate of ex-Gov. Lowndes, of Maryland, and David Sloan, of Lonaconing, Md., their water power on Shenandoah River, 4 miles southeast of Charlestown. The company has an engineer making surveys, and the power will be developed at once. It is stated that the company will build a trolley line from Harper's Ferry to Winchester by the way of Charlestown and Berryville. A line is also to be built from Berryville to Bluemont, Va., and probably from that point to Washington, D. C. The power is said to be capable of developing 2,000 h.p.

Essex, Ont.—The Dominion Government has given permission to the Windsor, Essex & Lake Shore Rapid Transit Co. to extend its line from this town to Tilbury, Ont.

Stratford, Ont.—A company has asked for incorporation under the name of the Perth & Hurson Electric R. R., and will operate from Stratford to Grand Bend and from Stratford to Tavistock.

Orillia, Ont.—The Ottawa Valley Electric R. R. is stated to have received permission from the Dominion Government to build two branch lines, on condition that they be finished within two years.

Toronto, Ont.—Messrs. Royce and Henderson, solicitors at Toronto, of the Toronto & Hamilton Electric Ry. Co., are applying to the Parliament of Canada for an act to sanction an arrangement with the Toronto & Niagara Power Co., for the use of the right of way of the Power Co., for the purposes of its railway and to increase its capital stock..

London, Ont.—The London, Chatham & Western Electric Ry. Co. is reported incorporated, with a capital of $2,000,000, to build 113 miles of track from London to Windsor. The company has also been granted permission to sell power with the consent of the municipal councils interested, and to sell light and heat with the consent by law of the people.

Galt, Ont.—The Hamilton Bd. of Wks. is stated to have decided to grant the Galt & Guelph Electric Ry. the right of way from the intersection of Main and Hess Sts. to Sundern and York Sts..

Hamilton, Ont.—The Hamilton, Guelph & North Shore Electric Ry., through its solicitor, Geo. Lynch Staunton, has applied to the Ry. Com. of Legislature for power to build a road between Hamilton and Butlington, around the bay, and thence to Guelph.

Brantford, Ont.—The City Council has granted the Brantford & Erie Electric Ry., which is to be built this summer as part of the radial system of railways, a western entrance into the city. It will run between Brantford and Port Dover.

RAILROADS.

Notes Arranged Alphabetically by States.

Valdez, Alaska.—A new Alaska railway company, to be known as the Copper River & Northwestern Ry. Co., is reported incorporated by John Rosene, Moritz Thomsen and M. M. Perl, of Seattle, Wash., and J. D. Trenholm, of Nome, Alaska. The company proposes to build a railroad from Valdez to Eagle City, with the privilege of extending the road to a point to be selected on Koyukuk River; capital $250,000. Principal office is given at Carson, Nev., and principal place of business at Seattle, Wash.

Denver, Colo.—A $100,000,000 mortgage for a bond issue to carry out the extension and improvement plans is reported to have been ratified at a meeting on June 15 of the stockholders of the Colorado & Southern R. R. (H. W. Cowan, Ch. Engr., Denver). The mortgage is mainly for to raise money to extend to the Gulf of Mexico, to pay for the Trinity & Brazos Valley Road in Texas, the Cripple Creek short line to Colorado, the Colorado & Northwestern in Colorado, to build double tracks between Pueblo and Trinidad, and to improve the Wyoming branch.

Miami, Fla.—Bids will be received at the office of J. C. Meredith, Constr. Engr., Florida East Coast Ry. Co., Miami, on July 31, for the construction and completion of reinforced concrete arch work on the proposed Key West extension, as advertised in The Engineering Record.

Tennville, Ga.—The Wrightsville & Tennville R. R. Co. (T. T. Holloman, Supt., Tennville) proposes constructing new terminals at Tennville, including roundhouse, shops, coal chute, etc., and to reduce some objectionable grades. Surveys are being made by Arthur Pew, of Atlanta.

Rock Island, Ill.—The Rock Island & Monmouth R. R. Co., of Chicago, has been incorporated with a capital of $5,000, to construct line from Rock Island to Monmouth. Incorporators: J. E. McGrath and C. W. Church, of Chicago.

Ardmore, Ind. Ter.—The final survey of the Canadian Valley & Western R. R., to be built from Lehigh to Chickasha via Purcell, 130 miles, is reported to have been completed and construction will soon commence. Articles of incorporation have been filed at Guthrie authorizing extensions of the proposed line from Tujelo, Ind. Ter., to a point near Paris, Tex.

Iowa Falls, Ia.—The Des Moines Shore Line is reported to be making a preliminary survey for the extension of its line northeast from this city. Terminus not yet decided upon.

Detroit, Mich.—W. S. Kinnear, of Detroit, will be engineer in charge of the construction of the tunnel under Detroit River for the Michigan Central R. R. Co.

Jersey City, N. J.—Ordinances are reported to have been passed by the Street and Water Bd., vacating parts of streets running through property acquired by the Erie R. R. Co. for carrying out its proposed $8,000,000 improvements, which include a new station and ferry and an open cut to replace the present tunnel through the Heights. In return for this grant the Erie R. R. Co. (Francis Lee Stuart, Ch. Engr., New York, N. Y.) agrees to give the city a school site at the Hudson Boulevard and St. Paul's Ave., to construct a new street to parallel its open cut through the Heights; to give city right to construct a sewer under its property, and to lay no tracks over sewer; to join city in construction of a sewer in Collard St. and Beacon Ave., and also to join in improvement of Monmouth St. when that work becomes necessary, and to buy water from city for two years at current rate.

Highland Mills, N. Y.—At a meeting of the State R. R. Comn. in the Whitehall Bldg., N. Y. City, an application was made, in the name of the Erie & Jersey Ry. Co., by the Erie R. R. Co. (Francis Lee Stuart, Ch. Engr., New York, N. Y.), for a certificate granting permission to con-

**Items marked thus give the names of parties awarded contracts.*

struct an extension branch and cutoff from Guymard to Highland Mills, a distance of 42 miles.

Fairport, O.—It is reported that the Baltimore & Ohio R. R. Co. will probable construct a line from Fairport, O., to Ashtabula, O., and construct docks at the latter city in order to increase its facilities for handling ore. D. D. Carothers, Ch. Engr., Baltimore, Md.

Portland, Ore.—The Oregon Railroad & Navigation Co. (Geo. W. Boschke, Ch. Engr.) is to construct a new line from Riparia to Lewiston along the north bank of Snake River, a distance of 70 miles. About one-half of the distance is under very high and precipitous bluffs and the roadbed is benched into these bluffs so as to get a firm roadway. There will also be a steel bridge of about 7 150-ft. spans crossing Clearwater River at Lewiston, one span of which will be a draw.

Philadelphia, Pa.—Local press reports state that bids will be received by Wm. H. Brown, Ch. Engr., Pennsylvania R. R. Co., on June 27, for grading, masonry work and track laying for the completion of a four-track system between Southwest Junction and the west end of the Donohoe tunnel. It comprises 400,000 cu. yds. excav., 500 cu. yds. of culvert masonry, 300 cu. yds. overhead masonry, 50,000 lbs. c. i. drain pipe and 30,700 ft. track laying; also same date for construction of a four-track line from east end of the Donohoe tunnel to Beatty's. This includes 700,000 cu. yds. excav., 1,000 cu. yds. bridge masonry, 50,000 lbs. c. i. drain pipe and 44,000 lin. ft. track laying; also on June 26 for a change of line and a new yard on the Princeton branch of the system. It includes 100,000 cu. yds. of excav. and 17,000 lin. ft. track laying.

Bristol, Tenn.—Press reports state that the Norfolk & Western R. R. Co. (C. S. Churchill, Ch. Engr., Roanoke, Va.) will expend about $100,000 in improvements in this city, including the construction of machine shops for repair work.

Mexia, Tex.—Surveys have been ordered for the location of an extension of the Trinity & Brazos Valley Ry., from Mexia or Coolidge via Corsicana, Waxahachie and Ennis to Dallas, about 75 miles. Connection will then be made with the Frisco and Rock Island properties. The locations from Mexia south to Houston, 105 miles, have been completed and contracts will be awarded soon. R. H. Baker, of Austin, is Gen. Mgr. and P. G. Burke, of Mexia, is Ch. Engr.

Stockdale, Tex.—Surveys have been completed for the extension of the San Antonio & Gulf Ry., from Stockdale to Cuero, 45 miles, and contracts will be let soon. J. M. Lee, Ch. Engr. & Gen. Mgr., San Antonio.

Hale Center, Tex.—The Frisco R. R. Co. (J. F. Hinckley, Ch. Engr., St. Louis, Mo.) is reported to have completed arrangements for the extension of its line westward to Hale Center, a distance of about 100 miles. An extension either to El Paso or Roswell, N. M., from Hale Center is contemplated, giving St. Louis a direct Frisco line to Pacific connections.

Ogden, Utah.—The Utah Constr. Co., of Salt Lake City, is reported to have secured the contract for constructing the Sand Ridge cut-off for the Oregon Short Line. The plans include the construction of an iron bridge across Weber River on 30th St.

Norfolk, Va.—The Ocean View & Pine Beach Ry. Co., of Norfolk, is reported incorporated by H. L. Pape, B. W. Leigh, M. C. Elliott and others, all of Norfolk; capital, $25,000.

Superior, Wis.—The Lake Superior & Southwestern R. R. Co., of Milwaukee, is reported to have filed an amendment to its charter providing for the construction of a line about 6 miles in length between Superior and Duluth, and passing through Douglas and St. Louis Counties. Howard Morris, Pres., and Geo. A. Kingsley, Secy.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

**Prescott, Ariz.*—The following are the bids opened June 12 by Capt. Chas. C. Walcott, Jr., Q. M., U. S. A., for constructing buildings at Whipple Barracks, Prescott: B. M. Zadeck Co., Chicago, Ill., $318,900; Morrison Contr. & Mfg. Co., Denver, Colo., $334,970; J. W. Wright, Leavenworth, Kan., $324,835; F. H. Barnes, San Francisco, Cal., $275,478 (awarded contract); Congress Const. Co., Chicago, Ill., $297,981, and Burrell Constr. Co., Oakland, Cal., $299,840.

*It is stated that other contracts in connection with the above buildings have been awarded as follows: to Newell Bros., of Los Angeles, Cal., plumbing at $23,635, and heating apparatus at $15,455, and electric wiring to F. E. Newberry, St. Louis, Mo., at $4,200.

Globe, Ariz.—It is stated that plans and specifications will be received until July 1 by Bd. Superv. (F. D. Fisk, Clk.) for a stone court house to be erected at a cost of about $35,000.

Newport, Ark.—Bids are wanted until June 28 for erecting a jail here: probable cost, $15,000. Address E. L. Boyce, Co. Judge.

Colorado Springs, Colo.—The following are the bids opened June 20 by the Superv. Archt., Treas. Dept., Wash., D. C., for the construction (except heating apparatus, electric conduits and wiring) of U. S. Postoffice and Court House at Colorado Springs: L. S. Atkinson, Colorado Springs, $117,422; G. W. Atkinson & Son, Colorado Springs, $115,829; Gillis Bros. Lumber & Bldg. Co., Colorado Springs, $123,000; Kroeger & Reimer, San Antonio, Tex., $97,637; J. A. McGonigle, Leavenworth, Kan., $116,400; H. A. Paine, Albert Lea, Minn., $109,274; Dieter & Wenzel, Joplin, Mo., $96,168; W. H. Maxwell, Pierre, S. D., $108,321; Morrison Cons. & Mfg. Co., Denver, $114,980; L. H. O'Neil, Denver, $116,900; J. H. Miers, So. Omaha, Neb., $101,250; Tom Lovell, Denton, Tex., $107,935; F. L. Stevenson Contr. Co., Dallas, Tex., $119,800; Wm. Weber, Beaumont, Tex., $116,000.

Norwich, Conn.—A bill has been passed by the Senate appropriating $420,000 for new buildings and water supply at the Norwich Hospital for the Insane.

**Greenbank, Del.*—Wm. D. Haddock & Co., it is reported, have received the contract to erect a 2-story addition to the workhouse at Greenbank to cost $32,278. The contract to construct the 80 steel cells, it is stated, was awarded to the Pauly Jail Bldg. Co., of St. Louis, Mo., at $16,925.

**Washington, D. C.*—W. E. Spier, Bliss Bldg., it is stated has secured the contract to erect the workhouse for males at $50,000, using red brick, bids opened June 3.

Honolulu, H. I.—The following are reported to be the bids opened on June 13 by Quartermaster Frank A. Grant, at Seattle, for constructing buildings, including plumbing, and electric wiring at the military post at Honolulu: Young & Potter, plumbing only, $19,879; Hastie & Dugan, entire work, $213,901; Brigdam & Haska, $196,987, entire work; J. E. Barnett, $243,792, entire work.

Galesburg, Ill.—It is reported that a municipal building is to be erected at a cost of $75,000.

Indianapolis, Ind.—Bids will be received until June 28 by the Bd. Pub. Wks. (M. A. Downing, Pres.) for erecting a fire station, at Webb and Raymond Sts.; also for installing steam heating and plumbing in said building; J. T. Johnson, Archt., 1113 State Life Bldg.

Petersburg, Ind.—It is stated that the Comrs. of Pike Co. have secured the approval of the State Bd. of Charities on their plans for a poor asylum and bids for the erectio nwill soon be asked. Probable cost, $15,000.

Jeffersonville, Ind.—The Comrs. of Clark Co., it is stated, have secured the approval of the State Bd. of Charities on their plans for the poor asylum, which is estimated to cost $15,000.

Goshen, Ind..—It is reported that the issue of $50,000 bonds to cover the cost of repairs and changes to the court house has been authorized.

Muncie, Ind.—Bids will be received on July 25 by the Superv. Archt., Treas. Dept., Washington, D. C., for constructing, complete, U. S. Post Office at Muncie, as advertised in The Engineering Record.

**Crawfordsville, Ind.*—Edw. Henry, of Tipton, has secured the contract for erecting the U. S. Post Office

Atlantic, Ia.—The following are the bids opened by the Superv. Archt., Treas. Dept., Washington, D. C., June 19 for the construction complete of U. S. Post Office at Atlantic: Walter Peterson, Omaha, Neb., $34,840; H. A. Paine, Albert Lea, Minn., $26,000; Butler Bros., St. Paul, Minn., $27,140; J. W. Miller, St. Paul, Minn. $26669; W. J. Turner Co. Chicago Ill. $29271; Northern Constr. Co. Milwaukee Wis., $30,280; Morse Constr. Co., Topeka, Kan., $29,936, and Bartlett & Kline, Cedar Rapids, $29,674.

Taylorsville, Ky.—Bids will be received by the Committee (W. M. Booles, Chmn.) for repairing and remodeling the Co. Court House.

New Orleans, La.—The Library Bd., it is stated, has accepted plans for a 2-story library which is to be erected on Lee Circle at a cost, including furniture, etc., of $214,000.

Monson, Mass.—Bids will be received until July 5 by the Trus. Mass. Hospital for Epileptics (Wm. N. Bullard, Chmn.) for erecting a building for the hospital.

Ft. Warren, Mass.—Bids will be received July 17 by Col. W. S. Stanton, Corps Engrs., U. S. A., Boston, for building a torpedo storehouse at Ft. Warren, as advertised in The Engineering Record.

Plymouth, Mass.—At the town meeting, held June 17, it was voted to erect a central fire station at a cost of $18,000, and to provide quarters for the Water Dept. at a cost of $12,000.

Worcester, Mass.—The Finance Com. has voted to recommend the erection of a police station at a cost of $90,000.

**Amesbury, Mass.*—Fissel & Wagner, of New York, N. Y., have secured the contract for constructing complete U. S. Post Office at Amesbury (bids opened June 8) for $40,120.

Grand Rapids, Mich.—The Soldiers' Home Bd., it is stated, has decided to receive new plans for the hospital which is to be erected at the Home at a cost of about $75,000.

Red Wing, Minn.—The Bd. Pub. Wks., it is stated, has recommended to the City Council that the contract for erecting the City Hall be awarded to Elliott Bros., of Minneapolis, at $21,340.

Minneapolis, Minn.—The Trus. of the Minnesota Soldiers' Home, it is reported, have decided to receive plans and bids for erecting a building at the Home for the use of the wives, widows and mothers of the old soldiers; appropriation, $75,000.

St. Paul, Minn.—It is stated that the Bd. Park Comrs. has decided to receive competitive plans for the pavilion which it is proposed erecting in Como Park at a probable cost of $30,000.

Westville, Miss.—It is stated that the Co. Bd. Superv. will receive plans and specifications until July 3 for repairing court house.

St. James, Mo.—The Bd. Trus., State Federal Home (H. E. Warren, Secy), will receive bids until July 6 for erecting a building to cost about $13,000; H. H. Hohenshield, Archt., Rolla.

St. Louis, Mo.—Thos. C. Link, Carleton Bldg., it is stated, has prepared plans for Barr Library, which is to be erected at Lafayette and Jefferson Aves., at a cost of $75,000.

Lewistown, Mont.—The Roman Catholics are said to be contemplating the erection of a hospital at a cost of $17,000. Rev. Francis Van Clarenbeck may be able to give further information.

Jersey City, N. J.—It is reported that $30,000 engine house bonds and $250,000 school bonds have been sold.

Mays Landing, N. J.—The Bd. of Freeholders, it is stated, are considering the improving of the court house at a cost of $20,000.

New York, N. Y.—The Mayor has signed a bill appropriating $170,000 for the construction and equipment of a station house, prison and stable for the 19th Prect. at 134 W. 38th St., Boro. Manhattan.

Plans have been filed for a 3-story and attic brick and stone library which is to be erected at 145th St. and Amsterdam Ave. at a cost of $90,000 by the New York Public Library Foundation. Arcts., McKim, Mead & White, 160 5th Ave.

Bids will be received until July 5 for furnishing materials and erecting 2 isolation ward buildings at the Riverside Hospital, North Brother Island, Boro. Bronx; also for installing a new boiler in boiler house at said hospital.

Bids will be received until July 12 by John W. Brannan, Pres. Rd. Trus., for labor and materials required for excavation, piling, mason, carpenter, steel, electric, ventilating and heating and other work for pavilions A and B, new Bellevue Hospital, 1st Ave. and 26th St., Boro. Manhattan. Estimated cost $600,000.

Westervelt & Auston, 7 Wall St., it is stated, have completed plans for the tuberculosis hospital which is to be erected by the Bd. of Health on North Brother Island. It is to be 3 stories high, 73x114 ft. and is to cost about $150,000.

The Bd. of Aldermen on June 20 appropriated $70,000 for the construction of new buildings for the Dept. of Correction. The workhouse and the penitentiary on Blackwells Island are to be improved under this appropriation.

Brooklyn, N. Y.—The following are the bids opened June 15 by the Comrs. of Parks, N. Y. City, for furnishing material and erecting steps and approaches to Eastern Parkway front of the Brooklyn Institute of Arts and Sciences: F. W. Carlin Constr. Co., 26 Court St., $107,000 (deduct $10,000 if stone balustrade is omitted); P. J. Carlin Constr. Co., 1 Madison Ave., N. Y. City, $88,900, and Richard E. Henningham, 4 Court Sq., Brooklyn, $93,405.

Bids were opened same time and place for furnishing material and erecting shelter house in Ft. Greene Park: F. W. Carlin Constr. Co., 26 Court St., Brooklyn, $32,000. P. J. Carlin Constr. Co., 1 Madison Ave., N. Y. City, $29,900; Geo. F. Driscoll, 391 Fulton St., Brooklyn, $32,519; Northeastern Constr. Co., Fuller Bldg., N. Y. City, $33,000; Geo. Stanton, 120 Worth St., N. Y. City, $33,947.

The Armory Bd., June 19, awarded the contract for the extension to the 13th Regt. Armory in Brooklyn to Walter E. Parfitt. The cost, including architect's fees, will be about $100,000.

**Ft. Totten, N. Y.*—Capt. Geo. H. McManus, Construcing Q. M., U. S. A., writes that the contract for constructin, etc., 2 double sets captains' quarters and 2 double set lieutenants' quarters (bids opened June 8) has been awarded to Casey & Hurley, of Bridgeport, Conn., for $83,760.

Bath, N. Y.—Bids will be received until July 3 by the Bd. Trus. New York State Soldiers' & Sailors' Home (Geo. W. Dunn, Pres.) for constructing, plumbing and electric wiring for carriage house and stable for headquarters, and addition to main kitchen at the Soldiers' & Sailors' Home; G. L. Heins, State Archt., Albany.

Rochester, N. Y.—J. Foster Warner, 1036 Granite Bldg., it is stated, has about completed plans for the Fire Headquarters bldg. which is to be erected at a cost of about $83,000.

Albion, N. Y.—Bids will be received until July 13 by the Bd. of Mgrs. of the Western House of Refuge for Women at Albion (John J. Hynes, Pres.) for the construction, heating, plumbing, electric wiring and fixtures, feeder cables and electric conduits for 2 cottages of inmates and assembly hall, as advertised in The Engineering Record.

Cleveland, O.—Bids will be received until June 29 by the Bd. Pub. Service (A. R. Callow, Secy), for furnishing materials and erecting a shelter house in Gordon Park.

Cincinnati, O.—The Bd. Pub. Safety, it is reported, recommends the issuing of $100,000 bonds for the erection of a station and patrol house.

Bids will be received until July 7 by the Bd. Co. Comrs. (C. C. Richardson, Pres.) for $50,000 Co. Insane Hospital Improvements bonds.

Lebanon, Pa.—The following are the supplemental bids recently received by the Superv. Archt., Treasury Dept., for constructing U. S. Post Office at Lebanon: Fissel & Wagner, New York, N. Y., $50,890; Richardson & Burgess, Washington, D. C., $50,647, and Mankin Constr. Co.; Richmond, Va., $56,000.

Allegheny, Pa.—See "Sewerage and Sewage Disposal."

**Lawndale, Pa.*—Burd P. Evans, 706 N. 9th St., Philadelphia, it is stated, has secured the contract to erect a 2-story stone addition, 40x147 ft., to the German Baptist Home for the Aged at Lawndale at a cost of $35,000.

Spartansburg, S. C.—Bids will be received by the Superv. Arch., Treas. Dept., Washington, D. C., July 26, for the construction complete of the U. S. Post Office at Spartansburg, as advertised in The Engineering Record.

**Rock Hill, S. C.*—Moise De Leon, of Atlanta, Ga., has secured the contract for erecting the U. S. Post Office at Rock Hill (bids opened June 6) for $32,500.

Tacoma, Wash.—It is stated that $30,000 has been appropriated by Congress for improvements to be made to the Federal prison which is situated on McNeill Island. Gen Caesar Clay is gen. agt. of the Dept. of Justice.

Madison, Wis.—It is stated that the Senate has passed a bill appropriating $100,000 for the erection of a State asylum for the vicious and criminal insane.

Ladysmith, Wis.—It is stated that bids will be received until July 15 by F. E. Monroe, Co. Clk., for erecting a sheriff's residence and jail.

Honolulu, H. I.—See "Miscellaneous."

Wallace, Idaho.—Bids will be received July 10 by the Bd. Co. Comrs. (Israel B. Cowen, Chmn.), for erecting a concrete block fireproof court house and jail, including ventilating and heating, lighting and plumbing; cost not to exceed $70,000. Stritesky & Sweatt, archts., Jamison Bldgs., Spokane, Wash.

Toronto, Ont.—It is stated that a $50,000 wing is to be erected at St. Michael's Hospital.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

**Los Angeles, Cal.*—It is stated that The Henry R. Angelo Co. has secured the contract to erect two 3-story brick business buildings for the Alexander estate at 9th St. and Bway at a total cost of $57,800.

Sacramento, Cal.—C. J. Matthews, it is stated, intends erecting a 3-story brick building on 5th and 6th Sts. at a cost of about $25,000.

Redding, Cal.—It is reported that the McCloud River Country Club bldg. has been destroyed by fire.

**Items marked thus give the names of parties awarded contracts.*

Tennville, Ga.—See "Railroads."

Idaho Falls, Idaho.—Bids will be received until July 1 by the State Bank for erecting a bank building. J. G. Link, Archt., 14 Silver Bow Block, Butte, Mont.

Indianapolis, Ind.—Dr. F. E. Jones, it is stated, will erect a 3-story, cement-block building at Udell and Clifton Sts. at a cost of $25,000.

It is stated that the Masons have purchased a site at New Jersey and Michigan Sts. and intend erecting a building to cost $200,000.

South Bend, Ind.—Archt. C. A. Brehmer, of South Bend, has completed plans for a polo rink to cost about $18,000.

Boone, Ia.—The erection of a $15,000 Y. M. C. A. bldg. is reported under consideration.

Kansas City, Kan.—Dr. L. D. Stockom, of Carrollton, O., it is stated, intends erecting a vaudeville theater on Minnesota Ave. and 6th St. at a cost of about $40,000.

Louisville, Ky.—Harry Weissinger, it is reported, has purchased a site at 4th Ave and Walnut St. and contemplates erecting a department store at a cost of about $1,000,000.

New Orleans, La.—It is stated that a building permit has been granted to Louis P. Rice to erect a 6-story building on Magazine St. at a cost of $35,000.

**Baltimore, Md.*—Jas. F. Farley, it is reported, has received the contract to erect a 5-story warehouse for Coggins & Owens at 19 S. Charles St., which is to cost about $20,000.

It is stated that bids are soon to be asked for erecting the Metropolitan Theater on E. Baltimore St., which is to have a seating capacity of 1,800 people.

Malden, Mass.—It is reported that Harry E. Converse intends erecting a business building at Washington and Pleasant Sts. at a cost of $150,000.

**Grand Rapids, Mich.*—Chas. Hoertz & Sons, 18 Porter Blk., it is reported, have received the contract to erect a fireproof warehouse on Bridge St. for the Grand Rapids Brewing Co., to cost $30,000.

Webster, Mass.—Racicot Bros., it is stated, will erect a 4-story brick building on Main St.

Menominee, Mich.—It is stated that the Masons are contemplating the erection of a temple at a cost of $25,000.

Omaha, Neb.—Fisher & Lawrie, Paxton Bldg., it is stated, have prepared plans for a Y. M. C. A. bldg. which is to be erected on Harney St. at a cost of about $100,000.

Jersey City, N. J.—See "Railroads."

**Atlantic City, N. J.*—Edwin Gilbert & Co., of Philadelphia, Pa., it is reported, have received the contract to erect an 8-story brick and stone hotel for the Marlborough House Co. at a cost of $670,000.

Newark, N. J.—Building permits have been granted to the Public Service Corporation to erect on the Plank Road, near Blanchard St., the following: Brick machine shop, estimated cost, $50,000; brick oil house, estimated cost, $3,000; brick storeroom, estimated cost, $10,000; two brick erection shops, estimated cost, $76,000, and two brick paint shops, estimated cost, $112,000.

New York, N. Y.—Plans have been filed for the 4-story banking house which is to be erected by the Chemical National Bank at Chambers St. and Bway at a cost of $350,000. Trowbridge & Livingston, Archts., 424 5th Ave. Plans have also been filed for improvements to cost $50000 to be made to the old A. T. Stewart, 10th St. store, adjoining the new Wanamaker stores, 4th Ave., 8th and 9th Sts.

Asheville, N. C.—J. M. Thrash, it is stated, intends erecting a 3-story business building at S. Main and Eagle Sts. at a cost of $20,000.

Charlotte, N. C.—W. S. Alexander, Secy Highland Hotel Co., writes that bids will be received July 6 for the erection of a hotel to cost about $150,000.

Toledo, O.—A. M. Chesbrough, it is reported, is interested in the erection of a 10-story hotel on the site of the present St. Charles at a cost of $75,000.

New Philadelphia, O.—Wurmser & Kramer, of Lorain, it is stated, are preparing plans for a 4-story brick and stone hotel which is to be erected here at a cost of $30,000.

Columbus, O.—Richards, McCarthy & Bulford, Ruggery Bldg., it is stated, are preparing plans for a 7-story business block which is to be erected by David C. Meeham at a cost of $300,000.

*Nichol & Carr, of Columbus, it is reported, have received the contract to erect the Capital Savings & Trust Co.'s bldg. on E. Broad St. at a cost of about $175,000.

Springfield, O.—It is stated that plans have been completed by the Cleveland, Cincinnati, Chicago & St. Louis R. R. (G. W. Kittredge, Ch. Engr., Cincinnati, O.), for the freight stations which it is proposed erecting in this city. It is reported that the construction of a viaduct and the erection of a new passenger station are under consideration. The cost of the improvements contemplated in this city by this railroad, it is reported, will amount to about $350,000.

Youngstown, O.—It is stated that the members of the Improved Knights of Pythias are contemplating the erection of a 3-story brick building to cost about $20,000. C. F. Brenner is a member of the Bldg. Com.

Homestead, Pa.—J. C. Rowland, of Pittston, it is stated, has prepared plans for the $30,000 building which is to be erected by the Odd Fellows' Home Assoc.

**Philadelphia, Pa.*—C. W. Denny, it is stated, has secured the contract to erect a 3-story laboratory at Wayne Junction for the Leeds-Northrup Co., which is to cost about $27,000.

A permit has been issued to Henderson & Co., 1221 Arch St., to erect a 3-story brick addition to building at 13th and Arch Sts. at a cost of $25,000.

Providence, R. I.—Martin & Hall, Union Trust Co.'s Bldg., it is stated, have about completed plans for the 3-story addition which it is proposed erected to the Boston store on Eddy and Fulton Sts.

Aiken, S. C.—C. C. Wilson, Columbia, S. C., it is stated, is the archt. for the $250,000 tourist hotel which is to be erected here.

Knoxville, Tenn.—It is reported that Miller Bros. Co. intend erecting a 4-story building at a cost of $15,000.

Chattanooga, Tenn.,—It is stated that the Elks Lodge has secured a site at Walnut and E. 7th Sts. and intends erecting a building at a cost of $20,000.

Harriman, Tenn.—The Masons of this city, it is stated, intend erecting a hall and theater at a cost of $17,000.

Dallas, Tex.—The directors of the Scottish Rite Bldg. Assoc., it is stated, are about to ask plans for a building which they propose erecting on Harwood St. at a cost of about $100,000.

Ft. Worth, Tex.—It is reported that the Bd. of Directors of the Masonic Widows and Orphans' Home is contemplating the erection of a girls' annex at a cost of $35,000.

Houston, Tex.—Addison H. Baldwin, of Houston, and W. H. Hammond & Co., Archts., also of Houston, are reported interested in the erection of a hotel in this city to cost about $1,000,000.

Seattle, Wash.—Plans have been prepared by H. Ryan & Co., Globe Bldg., for a 2-story brick flat and store building which is to be erected at 15th and Republican Sts. at a cost of $25,000. Mrs. Ellen Monroe, owner.

*Cawsey & Carney, it is stated, have received the contract to erect the 10-story brick and steel fireproof building for Jas. D. Lowman at 1st and Cherry Sts., including heating and plumbing, at $200,000.

Spokane, Wash.—Judge Geo. Turner, it is stated, intends erecting a theatre on Howard St. and First Ave. at a cost of $100,000.

Winnipeg, Man.—It is reported that the 7-story warehouse and store building of the Scott Furniture Co. on Main St. has been destroyed by fire.

**Toronto, Ont.*—It is reported that the Hamilton Bridge Co., 272 Caroline St., N. Hamilton, has secured the contract for the steel work for the Traders' Bank Bldg., this city. It is stated that approximately 3,500,000 lbs. of steel will be required and that the contract price is about $100,000.

NEW YORK, N. Y.

36 to 44 Attorney S, 6-story br and stone store and tenemt; c, $60,000; o, Maria L Tuers; a, Richd Rohl.

154 W 18th St, 8-story br and stone factory and loft bldg; c, $250,000; o, Chas Hellmuth; a, Adolf Schoeller.

Bway and 57th St, 6-story br and stone garage; c, $80,000; o, Benj Eichberg; a, Oscar Lowenson.

9th Ave and 47th St, 6-story br and stone store and tenemt; c, $50,000; o, Danl Meenan; a, J C Crocker.

229 E 121st St, 6-story br and stone store and tenemt; c, $25,000; o, L & M Romm; a, Saml Sass.

239 E 122d St, 6-story br and stone store and tenemt; c, $55,0000; o, Kramer & Rockmore; a, Geo F Pelham.

Bway and 62d St, 2-story br and stone automobile garage; c, $150,000; o, Wendel estate; a, Henry C Hollwedel.

157th St, Bway to Boule Lafayette, 2 br and stone store and office blds; c, $38,000; o, Adolph Lewishon; a, Small & Schumann.

5th Ave and 136th St, 3 br and stone stores and tenemts; c, $118,000 all; o, Lowe & Jorrisch; a, Saml Sass.

167th St and Southern Boule, two 5-story br stores and tenemts; c, $60,000 all; o, Jas C Gaffney; a, John J Kennedy.

Westchester Ave. and Simpson St., 6-story br store and tenemts; c, $45,000; o, Chas Kling; a, Kurtzer & Rentz.

42 W 39th St, 5-story br and stone rear extension; c, $27,000; o, Chas Thompson; a, John E Nitchie.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Denver, Colo.—F. E. Edbrooke, 510 Opera House Blk., it is stated, is preparing plans for the 3-story apartment house which is to be erected at California St. and 21st Ave. for Geo. Y. Brown, at a cost of $35,000.

**Atlanta, Ga.*—Gude & Walker, 713 Prudential Bldg., it is reported, have received the contract to erect the Grace Methodist Church, at a cost of about $40,000.

Carlyle, Ill.—It is reported that the members of the R. C. Church intend erecting an edifice at a cost of $35,000.

Tipton, Ind.—The members of the Christian Church, it is reported, have decided to erect an edifice at Washington and West Sts., at a cost of $20,000. Address Pastor.

Peru, Ind.—The congregation of the Amboy Quaker Church, it is stated, has selected a site and will soon ask bids for erecting an edifice estimated to cost $25,000.

**Rushville, Ind.*—It is reported that the Trus. of the United Presbyterian Church have awarded the contract to erect of Bedford stone the $25,000 edifice to Coats & Roberts, of Columbus, Ind.

Duluth, Minn.—It is reported that the members of the Polish Catholic Church have decided to erect a new edifice at a cost of $20,000. Rev. John Sroka, Pastor.

Minneapolis, Minn.—Edwins & Holden, it is reported, have prepared plans for a $20,000 edifice which is to be erected for the St. Paul Lutheran Church at 18th Ave. and 28th St. S.

A permit has been granted to Dr. E. L. Esterbrooke to erect a flat at Nicollet Ave. and 28th St. at a cost of $20,000. Ostlund & Miklund, contractors; J. W. Lindstrom, Andrus Bldg., archt.

W. C. Whitney, Loan & Trust Bldg., has prepared plans for a 2½-story stone and brick dwelling for W. H. Dunwoody, to cost $40,000.

E. L. Esterbrook will erect 2-story concrete block flats, at a cost of $20,000.

Austin, Minn.—It is reported that M. Lang intends erecting a $250,000 residence.

Newark, N. J.—The plans of Chas. Granville Jones, of Belleville, it is stated, have been accepted by the Bldg. Com. (Judge Alfred F. Skinner, Chmn.)), for the new edifice which it is proposed erecting for the Christ Reformed Church at Delevan and Washington Aves. Rev. Henry Merle Mellen, pastor.

Durham, N. C.—Plans have been prepared for a stone edifice which is to replace the present St. Phillip's Episcopal Church at a cost of $20.000.

East Palestine, O.—It is reported that the members of the Methodist Episcopal Church are contemplating the erection of an edifice at a cost of $20,000. Rev. Geo. W. Orcutt, Pastor.

McKeesport, Pa.—The Bldg. Com., of which Rev. Jas. Law is chmn., has been appointed by the congregation of the West End Methodist Church to have charge of the erection of a new edifice, to cost about $35,000.

**Ardmore, Pa.*—Metzger & Wells, it is stated, have secured the contract to erect a residence for H. Allen Dalley at Ardmore, at a cost of $20,000.

Philadelphia, Pa.—Andrew J. Sauer, it is stated, has been engaged by the Bldg. Com. of the Beth-Israel to prepare plans for a synagogue which is to be erected at 32d St. and Montgomery Ave. at a cost of about $50,000.

*Kendrick & Roberts, 1118 Chestnut St., it is stated, have secured a permit to erect the Calvary Church and Sunday school at 48th St. and Baltimore Ave., which is to be of brick and stone and cost about $70,000.

Stearns & Castor, Stephen Girard Bldg., it is stated, have been commissioned to prepare plans for a $30,000 residence to be erected at 1519 N. Broad St. for Edw. Wolf.

**Green Hill, Pa.*—P. M. Sharpless, of West Chester, it is stated, has awarded to Thos. H. Seeds, Jr., the contract to erect a residence at a cost of $200,000.

Oakmont, Pa.—R. Morris Trindle, of Pittsburg, it is reported, is preparing plans for an edifice for the congregation of the Episcopal Church which is to cost about $50,000.

Canton, S. D.—The members of the Norwegian Lutheran Church, it is stated, intend erecting a new edifice at a cost of $25,000.

Ft. Worth, Tex.—The vestry of St. Andrews Church, it is stated, has secured a site at Lamar and Jackson Sts. and intends erecting a stone edifice at a cost of $40,000. A committee has been appointed to secure plans and estimates and to report within 60 days.

Seattle, Wash.—It is reported that the congregation of the First Baptist Church will erect a $55,000 edifice. Rev. Dr. O. W. Banosdel, pastor.

Milwaukee, Wis.—Plans have been filed for a new edifice for the St. Jacobi Lutheran Church which is to be erected at Mitchell St. and 8th Ave. at a cost of $40,000.

Maysville, Wis.—Plans have been prepared, according to reports by M. O. Pillsbury, of Fond du Lac, for a residence which is to be erected by Dr. L. M. Bachhuter at a cost of $25,000.

NEW YORK. N. Y.

169 Rivington St, 5-story br and stone tenemt; c, $30,000; o, Dr. Moses Duckman; a, Max Muller.

20 Spring St., 6-story br and stone tenemt; c, $30,000; o, Gioacchino Acierno; a, John Caggiano.

5th Ave. and 52d St., 6-story br and stone residence; c, $500,000; o, Fredk G. Bourne; o, Ernest Flagg.

3d Ave. and 97th St., three 6-story br and stone tenemts; c, $130,000 all; o, Bornstein Bros.; a, Bernstein & Bernstein.

137th St. and 5th Ave., five 6-story br and stone tenemts; c, $200,000; o, Falk & Flam; a, Moore & Landsiedel.

149th St. and 8th Ave., ten 6-story br and stone tenemts; c, $500,000; o, M. & I. Hoffman; a, Lorenz F. J. Weiher.

156th St. and Bway, 6-story br and stone tenemt; c, $200,000; o, Henry T. Bulman; a, Schwartz & Gross & B. N. Marcus.

179th St. and Audubon Ave., 5-story br and stone tenemt; c, $75,000; o, Wallach, Reisler & Co.; a, Moore & Landsiedel.

Claremont Ave. and 127th St., two 6-story br and stone tenemts; c, $160,000 all; o, Jas. O'Brien; a, Denby & Nute.

St. Nicholas Ave. and 158th St., 5-story br and stone tenemt; c, $40,000; o, E. F. Cohn Realty Co.; a, Wm. C. Sommerfield.

St. Nicholas Ave. and 145th St., 6-story br and stone tenemt; c, $125,000; o, Aronson & Baum; a, Schwarz & Gross.

Wadsworth Ave. and 183d St., 6-story br and stone tenemt; c, $50,000; o, A. E. Bell; a, Moore & Landsiedel.

Fulton Ave. and 169th St., 5-story br tenemt; c, $35,000; o, Bates & Oesting; a, Neville & Bagge.

Lincoln Ave. and 136th St., five 6-story br tenemts; c, $300,000 all; o, Conforti Realty & Cons. Co.; a, Moore & Landsiedel.

Park Ave. and 173d St., two 5-story br tenemts; c, $105,000 all; o, Sweetman & Reich Bros.; o, Geo. F. Pelham.

Prospect and Westchester Aves., 6-story br tenemt; c, $45,000; o, Martha Graham; a, Harry T. Howell.

Tinton Ave. and 168th St., 5-story br tenemt; c, $35,000; o, Bates & Oesting; a, Neville & Bagge.

SCHOOLS.

Notes Arranged Alphabetically by States.

Anniston, Ala.—Wm. E. McIlvain, Pres. Alabama Presbyterian College, writes that the contract for erecting a building (bids opened May 5) has been awarded to J. H. Duke & Son, of Anniston, for $34,787.

Hot Springs, Ark.—It is stated that the School Bd. has purchased a site and intends erecting a school, at a cost of $50,000.

Phoenix, Ariz.—Bids will be received by C. W. Goodman, Supt. U. S. Indian School, for furnishing and delivering the following supplies: Plumbing, gas pipe fittings, cement; 1 15-h.p. motor; 800 electric lamps, etc.

Santa Clara, Cal.—Wm. Binder, of San Jose, it is stated, is the archt. for a high school, which is to be erected here, at a cost of $55,000.

Georgetown, D. C.—Mrs. Thos. F. Ryan, it is reported, has given $50,000 to the Georgetown Univ., to erect a gymnasium.

**Pueblo, Cal.*—Alex. Campbell, it is reported, has received the contract to erect the school, at $16,812.

**Decatur, Ga.*—Donaldson & Pierson, it is reported, have secured the contract to erect a 3 story brick dormitory at the Agnes Scott Inst. to be known as the Rebecca Scott Memorial Hall, and to cost about $60,000.

Dublin, Ga.—Bids will be received until June 30 by the Bldg. Com. at the Laurens Bank, for erecting a Sunday School building, for the Dublin Baptist Church; Geo. C. Thompson, Archt.

Greenville, Ill.—It is reported that a $30,000 administration building is to be erected at Greenville College.

**Items marked thus give the names of parties awarded contracts.*

**Galena, Ill.*—The contracts for erecting the high school, it is stated, has been awarded as follows: General construction to J. F. Schmidt Bros. & Co., Chicago, at $42,884; heating to Pond & Hasey Co., Minneapolis, Minn., $0,300, and plumbing to John Meyers, of Galena, at $2,000.

Chicago, Ill.—It is reported that 17 new schools are to be erected at a total cost of $1,717,500, the largest being a 26-room building at Kenmore and Sunnyside Aves., to cost $175,000.

**Linden, Ind.*—Peter Lavendowsky, of Lafayette, it is reported, has received the contract to erect a school here at $21,000.

**Crawfordsville, Ind.*—It is reported that the contract to erect the public school here has been awarded to Edw. Henry, of Tipton, at $35,000.

Lafayette, Ind.—Plans have been received for the engineering building, which is to be erected at Purdue Univ., at a cost of $40,000.

**Des Moines, Ia.*—Chas. Weitz & Sons, 713 Mulberry St., it is stated, have received the contract to erect the school at 16th St. and Forest Ave., at about $35,000.
*The Globe Plumbing & Heating Co., 518 E. Walnut St., it is stated, has secured the contract to install a heating plant in the East Des Moines high school, at $3,100.

**Grundy Center, Ia.*—G. E. Shearer, of Cedar Falls, Ia., it is stated, has secured the contract for the heating plant in the high school, at $3,065.

Schaller, Ia.—The citizens, it is stated, have voted to issue $15,000 bonds to erect a school.

Grinnell, Ia.—Iowa College Trus., it is stated, intend erecting a chapel at a cost of $30,000.

**Baton Rouge, La.*—L. J. Granary, City Clk., writes that the contract for erecting a 2-story brick school (bids opened June 12) has been awarded to Jas. D. Brown, of Baton Rouge, for $24,789.

Baltimore, Md.—The Com. on Property has reported to the First Branch of the Council favorably on the ordinance appropriating $38,000 for the fireproofing of the Eastern Female High School.

Quincy, Mass.—The City Council, on June 19, authorized the Comr. of Pub. Wks. to secure plans for a new addition to the high school; Hamilton Flood, City Engr.

St. Paul, Minn.—The Assembly Com. on Streets has voted favorably on the request of the School Bd. for a bond issue of $150,000, to be used toward the erection of a new high school, or the erection of an addition to the central high school.

Columbus, Miss.—It is reported that the School Bd. has decided to erect a $20,000 grammar school.

**Cape Girardeau, Mo.*—Archt. J. B. Legg, 715 Locust St., St. Louis, Mo., writes that the Iowa Mfg. Co., of Oskaloosa, Ia., has secured the contract for installing vacuum system and heat regulation in Science and Practice Halls, State Normal School, 3d Dist., bids opened May 23, for $40,281.

St. Louis, Mo.—Mrs. Wm. McMillan, it is stated, has given $200,000 to the Washington Univ. for the purpose of erecting a girls' dormitory.

**Emerson, Neb.*—W. G. Murton, it is stated, secured the contract for the erection of the school at $17,280, and Lewis & Kitchen, of Chicago, Ill., the contract for heating and plumbing, at $2,993.

**Concord, N. H.*—Walter H. Sargent, of Concord, it is reported, has received the contract to erect the brick gymnasium at the New Hampshire College of Agriculture and the Mechanic Arts at a cost of $22,850.

Kearny, N. J.—An ordinance has been adopted by the Council authorizing the issue of $82,000 school bonds.

Jersey City, N. J.—See "Public Buildings."

**Princeton, N. J.*—The J. W. Bishop Co., of Worcester, Mass., it is stated, has received the contract to erect a dormitory at Princeton Univ., at a cost of $150,000.

Jersey City, N. J.—See "Railroads."

Santa Fe, N. M.—It is stated that the Presbyterian Home Mission Bd., intends erecting a school here to be known as the Mary James Mission School for Boys, and the buildings to cost about $50,000.

New York, N. Y.—Plans have been filed for an 8-story br and stone school to be erected at 646 Park Ave., at a cost of $100,000 by Susan Dows Herter; arch., Edgar A. Josselyn, 45 E. 42d St. Also plans for alterations to be made to school at Academy St. and Kingsbridge Road, at a cost of $20,000; owner, City of New York; Archt., C. B. J. Snyder, 500 Park Ave.
Plans have been filed for a 4-story fireproof school, to be erected at 329 E. 63d St., for the Beth-El Sisterhood, of which Mrs. L. Kohns is Pres.; cost, $30,000. Pollard & Steinnam, Archts., 234 5th Ave.
Bids will be received until July 5 by C. B. J. Snyder, Supt. School Bldgs., for repairs to heating apparatus in 14 schools, Boro. Manhattan; alterations, repairs, etc., to 14 schools; repairs to heating apparatus of Schools 13, 20, 32, 38 and Morris High School; installing ventilating and heating apparatus in School 40, all in Boro. Bronx; alterations and repairs to 15 schools; fire escapes and alterations in School 35, Hollis, all in Boro. Queens; also for sanitary work and gasfitting of addition to School 18, Boro. Richmond.

Lyndonville, N. Y.—It is stated that plans have been accepted and that the Bd. of Educ. will soon ask bids for erecting the high school.

**Canandaigua, N. Y.*—Jas. E. Leamy & Co., of Syracuse, it is stated, have secured the contract to erect the Canandaigua Academy, at $100,000.

**Syracuse, N. Y.*—Leamy Bros., 331 S. Warren St., it is stated, have the contract for the mason work and John Hemmer & Sons, 213 Sunset St., the contract for the carpentry work on the convent and college building which is to be erected for the Order of Minor Conventuals on N. Salina St., the cost to be about $50,000.

Cincinnati, O.—The following are reported to be the lowest bids received June 13 for erecting the Fairmont School: Ventilating and heating, Peck-Hammond Co., $18,459; iron work, Walter Iron Co., $6,930; brick work, L. P. Hazen & Co., $23,894; plumbing, Thos. Canary, $8,890; electric wiring, Lawton Electric Co., $1,600; concreting, F. W. Folz & Co., $33,900; roofing, Witt & Brown, $7,393; excavating and masonry, Edw. Meier, $6,946, and carpenter work, Chas.. Rosenstiel, $18,141.
The Com. on Heating, Fixtures and Fuel, it is stated, has recommended to the Bd. of Educ. to appropriate $7,500 for improving the ventilating and heating system in the Columbia School.

**Wilberforce, O.*—Dr. W. A. Galloway, of Xenia, Pres. Bd. Trus. Wilberforce Univ., writes that the contract for erecting industrial building and assembly hall for Normal and Industrial Dept. (bids opened May 15) has been awarded to Henry Karg, Star Hotel, Columbus, for $38,018.

Zanesville, O.—It is reported that bids will be received until June 29 by the School Bd. (F. E. Geizer, Pres.) for furnishing materials and erecting a 1 or 2-story school on Market St.

Steubenville, O.—Bids will be received until June 30, by the Bd. Educ., Steubenville City School Dist., at the office of the Supt. of Schools, for erecting a high school at N. 4th and North Sts.; J. R. Webster, Archt.

**Girard, O.*—The Heller Bros. Co., Youngstown, it is stated, has received the contract to erect a 4-room addition to the high school, at $12,650.

Westerville, O.—The Bd. of Trus. of Otterbein Univ., it is stated, has accepted plans for the girls' dormitory, which is to be erected at a cost of about $25,000.

East Palestine, O.—Press reports state that bids will be received until July 7 by the Bd. Educ. (H. J. Fraser, Clk.) for erecting a school.

Springfield, O.—It is stated that a science hall is to be erected at Wittenberg College, at a cost of $50,000.

**Stillwater, Okla. Ter.*—Haycraft Bros. & Alexander, of Stillwater, have secured the contract for erecting a shop and gymnasium building for the Oklahoma A. & M. College (bids opened June 6) for $14,989.

Philadelphia, Pa.—The Bd. of Educ., it is stated, has selected a site at 15th and Mt. Vernon Sts. on which, it is proposed erecting the Commercial High School for Girls, for which an appropriation has been made amounting to $353,000.
*Chas. Gilpin, Penna. Bldg., it is stated, has received the contract to erect the training house for the athletes at the Univ. of Pennsylvania, which is to cost about $60,000.
It is reported that it is proposed erecting a $50,000 dormitory at the Univ. of Pennsylvania.

Sharpsburg, Pa.—A. H. S. Black, Boro. Clk., writes that the citizens voted June 13 to issue $85,000 school bonds.

Punxsutawney, Pa.—The citizens, it is stated, have voted to issue $65,000 bonds to erect a school.

Aspinwall, Pa.—Bids will be received June 29 by the Bd. Dirs., Aspinwall School Dist. (H. A. Stout, Secy.) for $22,000 school bonds.

Pawtucket, R. I.—The erection of a 12-room school in the Prospect St. Dist., it is reported is being considered by the School Com.

Humboldt, Tenn.—The citizens have voted in favor of issuing $12,000 bonds for remodeling or erecting a new school.

**Memphis, Tenn.*—Fred. B. Young, 1219 Mississippi Ave., it is reported, has received the contract to erect a 4-room addition to the Peabody School at $16,000, and for the erection of 2 schools for negroes, to cost $25,000.

Knoxville, Tenn.—Baumann Bros., 612½ Gay St., are reported to have completed plans for an 8-room school on Gratz Ave., to cost $15,000.
Great Barrington, Vt.—The School and Bldg. Committees of the new North St. School, it is stated, have accepted plans for the school which is to cost about $20,000.

Norfolk, Va.—The School Bd. is about to petition the Council for $60,000 for the erection of a high school.

Emory, Va.—The Bd. of Trus. of the Emory and Henry College, it is stated, are considering the raising of $100,000 for the erection of a new main building, a new dormitory and a central heating plant and water and light plants.

La Crosse, Wis.—John P. Bird, Supt. of Schools, writes that the bids will be received by the Bd. of Pub. Wks., July 6, for erection of a high school, to cost about $120,000. Architect, J. C. Llewyn, First Natl. Bank Bldg., Chicago, Ill.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Duluth, Minn.*—The Decarie Mfg. Co., of Minneapolis, is reported to have secured the contract for constructing a garbage crematory for about $29,000.

New York, N. Y.—Mayor McClellan on June 13 approved ordinances providing for the purchase, acquisition and construction of stock or plant for the Dept. of Street Cleaning as follows: $191,175 for Manhattan and Bronx Boros., $124,660 for Brooklyn Boro. and $90,000 for Richmond Boro.
Bids will be received until July 5 by the Dept. Pub. Charities (Jas. H. Tully, Comr.) for furnishing materials, erecting and completing a new garbage crematory and apparatus at Randall's Island, City of New York.

Port Chester, N. Y.—It is stated that bids will be received by the Village Trus. (C. D. Camp, Clk.) until July 3 for the disposal of garbage and ashes for 1 year.

Milwaukee, Wis.—A resolution was adopted by Common Council June 12 by which a special committee consisting of three members will be appointed to investigate the the advisability of installing a new system of disposing of the garbage at the municipal plant at Jones Island.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The Laycock Mfg. Co., Indianapolis, Ind., has secured a large site east of Brightwood, on which to erect a factory, for which plans are being prepared, according to local newspaper reports.

The Hazleton-Santiago Consolidated Mining Co. is planning to build a concentration mill and electric tramway on its properties near Georgetown, Colo., according to a Denver report. The mill will have a capacity of 40 tons daily, which can be increased to 75 tons if necessary, and the electric tramway will be 1½ miles long.

The Leeds & Northrup Co., 259 N. Broad St., Philadelphia, Pa., maker of electrical and scientific instruments, is having a 3-story, 108x55-ft. building erected, and is in the market for a power plant of about 25-h.p. capacity.

The Scranton (Pa.) Lace Curtain Co. is building an addition to its plant. Some small motors to drive individual machines will be the only additions to the power plant required.

The American Smelting & Refining Co., Cincinnati, O., has bought a site measuring 34x200 ft., on which to erect a new plant, according to local newspaper reports.

Plans have been prepared by C. P. Bossert for a 6-story, 64x168-ft. addition to the tannery of the Pfister & Vogel Leather Co., Milwaukee, Wis., according to local newspaper reports. It is stated that another addition of the same size will be built as soon as the addition now contemplated is completed.

Joseph Niehaus, Cincinnati, O., will erect a large factory building in Vogt St., between Richmond and Court Sts., according to local newspaper reports.

It is stated that W. C. Magee, president of the Pickands-Magee Coke Co., Pittsburg, Pa., and other prominent steel manufacturers and coke operators, have bought the property of the Riverview Coal & Coke Co. in the Masontown field, and that plans will be perfected at once for extensions and improvements that will involve a total output of $1,500,000. It is reported that a new company, the Southern Connellsville Coke Co., has been organized and that W. C. Magee will be president of the company.

At the annual meeting of the preferred stockholders of the Union Bag & Paper Co., of Sandy Hill, N. Y., a proposition to issue $5,000,000 of 5 per cent. bonds was ratified. It is proposed to sell $3,000,000 of the authorized issue at once to retire the present floating indebtedness, complete the purchase of additional timber lands, to provide for an additional wood pulp mill at Hadley, and to furnish additional working capital.

Geo. K. Hamfeldt, Etna and 14th Sts., Pittsburg, Pa., writes that while it is contemplated to erect a new blast furnace, details are as yet unavailable.

The Southern Star Mining Co., Acworth, Ga., will erect a plant to include a 24x40-ft. boiler house and compressor room, 30x60-ft. engine room and mill for treatment of pyrites, 20x40-ft. stamp mill and concentrating room, a hoisting engine room 20 ft. square, counting house, office, machine shop, stables, etc. Two 100-h.p. and one 25-h.p. boilers, compressor, hoisting engine, crusher, 10-stamp mill, concentrating tables, air drills, pumps, etc., will be installed. Fred. S. Wilson, vice-pres. & gen. mgr.

E. R. & D. C. Kolp, Jr., Ft. Worth, Tex., will probably build a grain elevator at Oklahoma City, Okla. Ter., within the next year.

Sargent & Co., New Haven, Conn., lock and hardware manufacturers, have plans for a 5-story building, about 600 ft. long and 50 ft. wide. Work has begun on one section, 237x50 ft., and foundations have been laid and the contract let for the upper part of a smoke-stack 135 ft. high. Steam boilers of 950 h.p. capacity will be installed.

The Fremont (O.) Grape Juice Co. will erect a plant to consist of a 3½ story and basement, 42x85-ft. main building and a 16x30-ft. engine room, to have concrete foundations and walls of concrete blocks. A 20-h.p. and a 12-h.p. boiler for cooking purposes and a 10-h.p. motor will be installed.

The Atlanta (Ga.) Agricultural Works contemplate the erection of a new plant to cover about 3 acres and will use about 200 h.p. Clyde L. King, pres.

The Twentieth Century Heating & Ventilating Co., Akron, O., contemplates erecting a new plant, but details have not been decided.

L. H. Focht, Reading, Pa., has been awarded contract for an addition to the plant of the Globe Knitting Mills, Norristown, Pa.

The Union Drawn Steel Co., Beaver Falls, Pa., will erect a 225x108-ft. plant at Hamilton, Ont. The plant will probably be operated by electricity and the machinery will practically all be of the company's design.

A 60-ft. addition will be erected to the plant of the Southland Knitting Mill, Macon, Ga. E. Lee Campe, 97 Franklin St., New York, pres.

The Benton (Ark.) Canning Co. expects to erect a building about 30x60 ft. in size, having a capacity of about 5,000 as an initial installation.

The Schmauss Co., Rockford, Ill., has not yet completed arrangements concerning the erection of its new packing plant.

The International Acheson Graphite Co., Niagara Falls, N. Y., contemplates building a plant in Canada. It will probably consist of one 50x100-ft. corrugated iron building, in which 200 h.p. of electrical power will be used.

Wm. Steele & Sons, Philadelphia, Pa., have taken out permits to erect a 5-story, 252x55-ft. brick factory, to cost $95,000, on Allegheny Ave., bet. Boudinot and Hurley Sts., and a 95x23-ft. brick power house, to cost $6,000 on Hurley St., below Allegheny Ave.

It is reported that the American Steel Foundries Co. will soon authorize an issue of $4,000,000 or $5,000,000 bonds, to be used making improvements and modernizing the various plants and to furnish additional working capital.

The Caledonia (N. Y.) Marl & Lime Co., whose plant was recently burned, has not decided as to the size of the building to be built, but is getting estimates on cement construction and also steel construction. The new additional drying shed, which will be of wood, will be at least 100 ft. long and will be built at once.

It is understood that plans are being prepared by the Carnegie Steel Co. for the erection of a rail mill at the Edgar Thomson Steel Works, at Braddock, Pa., which will more than double the capacity of the plant.

Deere & Co., Moline, Ill., will build a 150x60-ft.

**Items marked thus give the names of parties awarded contracts.*

addition to their foundry, doubling the floor area, according to local newspaper reports.

The Cuyahoga Brewing Co., Cleveland, O., has been incorporated, with a capital of $30,000, by Jos. Schwartz, A. W. Stradler and H. C. Seringer. The company's plans include the erection of two plants, one in Cleveland and an auxiliary plant near that city, according to local newspaper reports.

The Innes-Demarest Stove & Heater Co., Binghamton, N. Y., has let a contract to the Carrington-Ford Co. for the erection of a manufacturing building to cost about $30,000, according to local newspaper reports.

Nashville newspaper reports.

The Bauer Cooperage Co., Lawrenceburg, Ind., has bought a site of 7 acres in Nashville, Tenn., and will erect a large plant, locating its main plant there and continuing the Indiana plant as a branch, according to

The Monarch Paper Co., Kalamazoo, Mich., is erecting a 2, 3 and 5-story, 430x80 to 250-ft. building, according to local newspaper reports. The machinery will be driven by electricity generated in the plant.

The F. J. Lewis Mfg. Co., Daveport, Ia., has let contracts for the erection of a 50x150-ft. machine building, according to local newspaper reports.

The Morden Frog & Crossing Co., Chicago, Ill., has secured a site of 12 acres in Chicago Heights, where it will immediately erect a new plant, according to local newspaper reports.

A large addition is to be built to the factory of the Eaton-Hurlbut Paper Co., Springfield, Mass., according to local newspaper reports.

The 1900 Washer Co., Binghamton, N. Y., will erect a 140x40-ft. addition to its plant, according to local newspaper reports.

Chalmers & Williams, Chicago, Ill., will at once begin the erection at Chicago Heights of a 100x200-ft. main building, equipped with a 20-ton traveling crane; a 42x40-ft. pattern shop; a 42x75-ft. power plant; a 42x80-ft. blacksmith shop, and an office building, according to local newspaper reports.

The Davis Foundry & Machine Works, Rome, Ga., are in the market for a 10-ft. vertical boring and turning mill, two heads, 1 milling machine for general machine shop work, one planer about 44 to 48 in. square by 9 to 10 ft. long, two hand-power traveling cranes of about 7 tons capacity and 35-ft. span, and one small compressed air outfit for drilling and chipping, preferably second hand.

Knowlton Bros., Watertown, N. Y., will build a 135x45-ft. addition to their paper mill. Plans have been prepared by Jos. H. Wallace, New York City.

The Herron & Bury Mfg. Co., Erie, Pa., manufacturer of air compressors, has begun building an addition to its plant. which will double the capacity.

The Newport News, Va., Shipbuilding & Dry Dock Co. is arranging for the construction of another large dry dock, new shipways and other improvements, but particulars are not yet available. W. A. Post, gen. mgr.

The Pine Tree Silk Mills Co., 806-810 Arch St., Philadelphia, Pa., is erecting a 5-story and basement, 300x50-ft. building. There will also be a 25x90-ft. power house, and two boilers of 150 h.p. and a 150-k.w. direct-connected dynamo will be installed. The machinery will be motor driven.

The John D. Wing Co., 405 Equitable Bldg., Atlanta, Ga., is erecting a 4-story and basement, 45x120-ft. candy factory, and is in the market for a 100 h.p. boiler and a 25-h. p. slide valve engine.

J. S. Maclean, 161 West Spring St., Columbus, O., manufacturer of bank, office and store fixtures, has bought a site of about 2 acres on the Hocking Valley R. R. and will erect a 3-story, 80x120-ft. main building of semi-mill construction, an additional dry kiln, warm rooms and sheds. The power plant will consist of a 100-h.p. engine, driving by belt a 60 or 75-k.w. generator. Exhaust steam will be used in dry kilns and to heat plant by the blower system; machines will be run by individual motors or in groups, requiring from 15 to 20 motors from 5 to 25 h.p. capacity, and a shavings exhaust system and a sprinkler system for fire protection will be installed. The machinery from the present plant will also be removed to the new site.

The Edwards Mfg. Co., 115-121 Sycamore St., Cincinnati, O., manufacturer of sheet metal building material, intends to build a new plant. No additional power plant will be required.

W. C. Gray, Deweyville, Tex., and associates, contemplate erecting a saw and shingle mill in Beaumont, Tex., to have a capacity of 20,000 to 25,000 ft. of lumber and 60,000 to 75,000 shingles. The company will have a capital of $30,000 and will require complete equipment for the plant.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—Maj. W. E. Craighill, Corps. Engrs., U. S. A., writes that the Southern Dredging Co., of Mobile, bid on June 15 for dredging Mobile Bar, 30 cts. per cu. yd.

**Little Rock, Ark.*—The Thomas-Fordyce Mfg. Co., of Little Rock, secured the contract for the iron work for Lock No. 3, Upper White River, Ark. (bids opened June 10, by Maj. G. D. Fitch, Corps. Eugrs., U. S. A.) at the following bid: 4,340 lbs. cast steel, 6.9 cts.; 13,880 lbs. cast iron, 3.8 cts.; 10,600 lbs. steel, 5.8 cts.; 20,480 lbs. wrought iron, 4.9 cts., and 285 lbs. crane chain, 10 cts.; total, $2,475.

*The bids for 11,000 bbls. of American Portland cement for Lock No. 3, bids opened same time and place as above, were as follows: Edwin S. Healey, 1400A Old Manchester Road, St. Louis, Mo., $1.84 per bbl. (awarded contract); Atlas Portland Cement Co., New York, N. Y., $1.85, and Leiper & Mills, Little Rock, $2.33.

Wilmington, Del.—The following are the bids opened June 19 by Capt. C. A. Flagler, Corps Engrs., U. S. A., for dredging in Tuckerton Creek (price given per cu. yd.): Ernest L. Miner, Washington, D. C., 16 cts.; Edw. J. Fonder Co., Philadelphia, Pa., 16 cts., and Anson J. Rider, Tuckerton, N. J., 15⅞ cts.

Bids were also opened June 20 for dredging in Racoon Creek, N. J.: Patk. Neary, Wilmington, 15 cts.; River & Harbor Improv. Co., Philadelphia, Pa., 17 cts., and Edw. J. Fonder Co., Philadelphia, Pa., 9½ cts.

Washington, D. C.—Bids are wanted July 5 (extension of date) for furnishing 36-in. searchlight outfits, as advertised in The Engineering Record.

Washington, D. C.—Bids will be received until July 18 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the Navy Yards, New York, N. Y., and Mare Island, Cal.., a quantity of steel plates, channels, angles, shapes and castings, aggregating about 8,660 tons; also same date for furnishing at the Naval Station, Guantanamo Bay, Cuba, a quantity of steel sheet jailing, steel rails, and plates, cut-off valves, iron wheels, etc.; H. T. B. Harris, Paymaster-Gen., U. S. N.

Augusta, Ga.—The following are the bids opened June 8 by Lieut. Col. Jas. B. Quinn, Corps Engrs., U. S. A., Savannah, for constructing dikes in Savannah River near Augusta: Wm. H. Virden, Tampa, Fla., $11,900; A. J. Twiggs, Augusta, $7,775 (recommended for acceptance), and Simons-Mayrant Co., Charleston, S. C., $10,135.

Savannah, Ga.—The following are the bids recently received for installing electric passenger elevator at the Marine Hospital at Savannah; Marine Engine & Machine Co., New York, N. Y., $6,712, and Otis Elevator Co., New York, N. Y., $6,780.

Honolulu, H. I.—The following are the bids opened on June 15 by the Superv. Archt., Treas. Dept., Washington, D. C., for construction and wharf and roadway, laundry building and plant, retaining wall and dredging at U. S. Quarantine Sta., Honolulu (bidder of Honolulu unless otherwise mentioned): Hawaiian Dredging Co., $62,800; W. H. Hoogs, $63,433; John Onderdonk, $62,500; F. W. Bradish, $67,409; E. P. Chagoin, $74,052; S. M. Whitehouse, $64,985; Lord & Belser, $64,499; San Francisco Bridge Co., San Francisco, Cal., $66,250; Henry Tibbetts Construction Co., San Francisco, Cal., $63,300; Pacific Construction Co., San Francisco, Cal., $69,500; Cotton Bros. Co., Oakland, Cal., $59,855, and Langford & Waller, Portland, Ore., $85,900.

Iowa City, Ia.—W. J. McChesney, Secy. Bd. Regents State Univ., writes that the contract for constructing a concrete dam across Iowa River (bids opened June 13) has been awarded to Wm. Horrabin, of Iowa City; cost about $13,000.

Louisville, Ky.—The following are the totals of bids opened June 15 by Capt. H. Burgess, Corps Engrs., U. S. A., for steel trestles, etc., for Boulevard Dam, at falls of Ohio river: Chas. Hegewald Co., New Albany, Ind., $26,995.13; Penn Bridge Co., Beaver Falls, Pa., $24,444; B. Wallis & Co., Baltimore, Md., $27,889; Griffith Iron Wks Co., St. Louis, Mo., $23,125; Milwaukee Bridge Co., Milwaukee, Wis., $21,268; Lawrence D. Weoning, Cleveland, O., $24,882; The Brackett Bridge Co., Cincinnati, O., $119,664; The North Penn Iron Co., Philadelphia, Pa., $33,646; The Interstate Engineering Co., Cleveland, O., $24,081; Grainger & Co.; Louisville, Ky., $23,814; New Jersey Foundry & Machine Co., New York, N. Y., $27,034, and Champion Iron Co., Kenton, O., $18,995.

Baltimore, Md.—The following are the bids opened June 20 by Lieut. Col. R. L. Hoxie, Corps Engrs., U. S. A., for dredging Patapsco River and Chesapeake Bay, Md., *a* 7,102,222 cu.. yd. Sect. A, *b* 719,999 cu. yd. Sect. B, *c* 1,552,779 cu. yd. Sect. C (price given per cu. yd.): Chas. W. Eaton, Haverhill, Mass.,*a* 6.45 cts.; Maryland Dredging & Contr. Co., Baltimore, *a* 7 cts., *b* 20 cts., *c* 23 cts.; American Dredging Co., Philadelphia, Pa.; *a* 8½ cts., *b* 22 cts., *c* 29 cts.; Morris & Cummings Dredging Co., New York, N. Y., *c* 32 cts.; Columbia Dredging Co., New York, N. Y., *a* 9.9 cts., *b* 27 cts., *c* 35 cts.; Sanford & Brooks Co., Baltimore, *a* 9 cts., *b* 25 cts., *c* 30 cts.; North American Dredging Co., San Francisco, Cal., *a* 16 cts., *b* 60 cts., *c* 30 cts.

Boston, Mass.—Bids will be received by the Bd. of Harbor & Land Comrs. (Woodward Emery, Chmn.) for constructing about 900 ft. of timber dike and 1,000 ft. of wood fence with sand embankment at eastern end of Stage Harbor, Chatham.

**Ft. Andrews, Mass.*—The contract for furnishing material and constructing a section of sea wall, etc. (bids opened June 19) has been awarded to Robt. B. Mitchell, 115 Nassau St., New York, N. Y., for $2,973.

Newton, Mass.—Bids will be received until June 28 by Chas. W. Ross, Street Comr., for widening, deepening, straightening and relocating Hammond Brook. Irving T. Farnham, City Engr.

Detroit, Mich.—See "Railroads."

**St. Paul, Minn.*—Geo. A. Ralph, State Drainage Engr., Crookston, writes that contract for 3 ditches (bids opened June 15) have been awarded as follows: To John Kohler, of Frazee, Minn., for 20,000 cu. yd. peat, 14.4 cts., and 10,000 cu. yd. peat and clay, 11.4 cts., and to Standard Dredging Co., of Windom, 104,000 cu. yd. clay, sand and gravel, 13.5 cts.

Newark, N. J.—Bids will be received until June 27 by the Essex Co. Park Comn. (A. Church, Secy.) for construction of concrete foundations, coursed rubble masonry and the furnishing and setting of bluestone steps, coping, etc., at West Side Park; also same date for furnishing and setting bluestone coping or the construction of concrete coping for the exterior masonry walls at said park.

**New York, N. Y.*—The following are the bids opened June 16 by the Dept. of Docks & Ferries, for furnishing and delivering about 10,000 bbls. Portland Cement (price given per bbl.): Standard Materials Co., 1 B'way, $1.58; John F. Kane Co., 287 4th Ave., $1.41 (awarded contract).

*The following are the bids opened June 19 by the Dept. Docks & Ferries for furnishing material and building piers, *a* Pier No. 8, East River, foot of Cuyler's Alley, *b* Pier No. 10, foot of Old Slip: Godwin Constr. Co., 60 Wall St., *a* $46,255, *b* $45,555; Barth S. Cronin, 573 Clinton St., Bklyn., *a* $43,675, *b* $43,900; Bernard Rolf, 39 Cortlandt St., *a* $41,453 (awarded contract), *b* $41,678 (awarded contract); Wm. H. Jenks, 129 Pearl St., *a* $44,980, *b* $44,555; R. P. & J. H. Staats, 29 Bway, *a* $43,950, *b* $44,355; Wm. E. Rogers, 44 Bway, *a* $49,660, *b* $50,960.

Bids will be received until June 29 by the Park Bd. (John J. Pallas, Pres.) for furnishing and delivering 2,000 cu. yds. of broken stone of trap rock; 3,500 cu. yds. screening of trap rock, for parks, Boro. Bronx; also same date for furnishing materials, regulating drainage, irrigating and inclosing McLaughlin Park, Boro. Brooklyn.

The Bd. of Aldermen on June 20 appropriated $1,000,000 for playgrounds and $300,000 for athletic fields in all of the boroughs except Manhattan.

Brooklyn, N. Y.—Bids will be received until July 6 by the Park Bd., New York City (John J. Pallas, Pres.) for furnishing and delivering Hudson River road gravel on parks and parkways, Boros. Brooklyn and Queens.

**Ft. Wood, N. Y. H., N. Y.*.—Capt. Traber Norman, Constr. Q. M., U. S. A., Governor's Island, N. Y. H., writes that the contract for constructing addition to wharf and warehouse at Ft. Wood (bids opened June 5) has been awarded to the North-Eastern Constr. Co., Fuller Bldg., N. Y. City, for a total of $35,484.

Rochester, N. Y.—Engr. Lyman E. Cooley, of Chicago, Ill., employed by Mayor Cutler to advise city as to best route for barge canal, submitted his report to Bd. of Aldermen on June 13 and recommends that the "Bond," or middle route, for the canal be adopted. This route would take the canal across river about at Brooks Ave. In connection with this route Mr. Cooley advises building a big harbor for boats in river between state dam and Court St. Bridge, and also advises that the eastern widewaters be reserved for harbor development. He advises that present canal on west side be retained as far as main line of New York Central R. R. and that it be done away with from that point east to Goodman St. The quantities involved in treating river as proposed have been approximately estimated from the data available. For channel 18 ft. deep below elevation 251 ft. city datum, and 400 ft. wide between dock walls of masonry carried to elevation 254 ft., and for a length of 11,000 ft. between controlling dam and canal entrance below state dam—Middle Route. Rock, 826,000 cu. yd.; earth, 318,000 cu. yd.; masonry dock wall, 64,000 cu. yd.; superstructure of Clarissa St. Bridge to be changed to a through bridge without change of grade; controlling dam 200 ft. above center line of Court St. Bridge. If the same treatment is extended 5,000 ft. to South Route it will add quantities as follows: Rock, 666,000 cu. yd.; earth, 240,000 cu. yd.; wall, 20,000 cu. yd.

*The Bd. of Contract and Supply is stated to have awarded to the New Jersey Bridge Co., of New York, the contract for a steel shed on the south side of the public market for $6,218.

Fargo, N. D.—It is stated that surveys are about to be made for a system of drainage in Cass, Traill, Grand Forks and Walsh Counties. The work will be in charge of John T. Stewart, of the U. S. Dept. of Agriculture, of Washington D. C. with Engineer T. R. Atkinson, of Fargo, Asst. State Engr.

Vermillion, O.—The Buckeye Constr. Co., of Cleveland, submitted the lowest bid opened to Lieut. Col. Dan C. Kingman, Corps Engrs., U. S. A., June 8, for harbor work at Vermillion, as follows: 2,000 tons paving stone, $2.60; 3,000 tons rip-rap stone, $1.70, and 1,200 lin. ft. preparing old pier, $1.50; total, $12,100. The only other bid received was from the L. P. & J. A. Smith Co., of Cleveland, for $14,400.

**Cleveland, O.*—Lieut. Col. Dan C. Kingman, Corps Engrs., U. S. A., writes that the contract for removing wreck of the steamer "Shenango," No. 1, near entrance to Conneaut Harbor (bids opened May 25), has been awarded to Chas. W. Johnston, of Lewes, Del., for $4,900.

Panama.—The following are the bids opened by the Panama Canal Comn., Washington, D. C., on June 15 for excavation of and entrance to Inner Harbor, Canal Zone, Isthmus of Panama; G. W. Kelt, of New York, N. Y., bid for Harbor Stations 0 to 51, for coral and other rock, 40 ft. deep, 1,380,000 cu. yd., $2.10; 35 ft. deep, 865,000 cu. yd., $2, and 30 ft. deep, 650,000 cu. yd., $2, and for indurated clay, $1.50 per cu. yd., and for sand and mud, 40 ft. deep, 3,460,000 cu. yd., 17½ cts.; 35 ft., 3,125,000 cu. yd., 17 cts., and 30 ft., 2,500,000 cu. yd., 17 cts. He also bid on Harbor Sta. 51 to 100, $5.20, $5 and $4.80, and $1.05, $1 and 95 cts. per cu. yd., and for removing material, 1½ cts. to 14 cts. The North American Dredging Co., of San Francisco, Cal., bid for Sta. 0 to 51, coral and other rock, 40, 35 and 30 ft. deep, $2.82; indurated clay, all three, 76 cts., and mud, sand and stiff clay, all three, 24.8 cts. He bid for Sta. 51 to 100, coral and other rock, $6.60; indurated clay, 76 cts., and mud, sand and clay, 24.8 cts. Michael Dady, of Brooklyn, bid for unclassified excavation, 40 ft. deep, 63 cts.; 35 ft. deep, 71 cts., and 30 ft. deep, 79 cts.

Bids will be received by the Isthmian Canal Comn. at Washington, D. C., July 24. for furnishing a destructor at Bas Obispo, Isthmus of Panama, as advertised in The Engineering Record.

Allegheny, Pa.—See "Sewerage and Sewage Disposal."

**Kutztown, Pa.*—The contract for constructing ½ mile of race track at Kutztown, has been awarded to Focht & Missiner, for $11,000; Lehr & Bascom, Allentown, Engrs.

Charleston, S. C.—Bids are wanted July 20 for removal of wreck of schooner "Kate V. Aitken," Charleston Harbor, as advertised in The Engineering Record.

Memphis, Tenn.—Bids are wanted July 17 for furnishing steel and silicon bronze wire, wire strand, etc., as advertised in The Engineering Record.

Pittsburg, Pa.—Bids will be received until July 21 by Maj. Wm. L. Sibert, Corps. Engrs., U. S. A., for furnishing and installing compressed air machinery for new Lock No. 2, Monongahela River.

Philadelphia, Pa.—Bids are wanted July 17 for dredging in Delaware River, bet. Finn's Point and south line of Pennsylvania, as advertised in The Engineering Record.

Newport News, Va.—The Newport News Shipbuilding & Dry Dock Co. will construct a new dry dock. new shipways and make other improvements, but particulars of same are not yet available. W. A. Post, Gen. Mgr.

Norfolk, Va.—The following are the bids opened June 19 by Capt. E. Eveleth Winslow, Corps Engrs., U. S. A., for dredging Perquimans River, N. C., 20,000 cu. yds. (price given per cu. yd.): L. M. Lewis, Berkley, Va., 47½ cts., and Chas. P. Guin, Philadelphia, Pa., 77 cts.

Sunnyside, Wash.—It is reported that E. J. Young has been appointed by the Co. Comrs. as Supervisor of the Central Sunnyside Drainage Dist. and work on constructing a drainage system will soon commence.

Bremerton, Wash.—Bids will be received until July 29 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for removing 65,000 cu. yd., more or less, of material from waters of navy yard, Puget Sound, Wash.; estimated cost, $24,000.

Milwaukee, Wis.—Maj. J. G. Warren, Corps Engrs., U. S. A., writes that all bids opened May 16 for improving the harbor at Waukegan, Ill., by removing old piers and building pile piers and timber superstructure have been rejected. The lowest bid received for this work amounted to $68,401.

**Items marked thus give the names of parties awarded contracts.*

*Maj. J. G. Warren, Corps Engrs., U. S. A., writes that the contract for improving the harbor at Milwaukee by constructing a concrete superstructure in breakwater and on North Harbor Pier (bids opened May 16) has been awarded to Wm. H. Gillen, of Milwaukee, for $111,696; also that Jos. Wolter, of Sturgeon Way, Wis., has secured the contract for dredging Gladstone Harbor, 85,000 cu. yd., for a total of $11,050. For list of bids received for the three above contracts see issue of The Engineering Record May 27.

PROPOSALS OPEN

For Proposals see pages 56, 61, 62,63, AND 64.

WATER WORKS.

Bids Close.		See Eng. Record.
Jun. 27.	Pipe laying, Cincinnati, O.	Jun. 3
Jun. 28.	**Irrig. work, Billings, Mont.** Adv. May 6 to June 10.	May 6
Jun. 28.	**Pump sta., etc., Huntley, Mont.** Adv. May 6 to June 10.	May 6
Jun. 28.	Pipe, etc., Buffalo, N. Y.	Jun. 17
Jun. 29.	Filtration plant improv., Wash., D. C.	Jun. 17
Jun. 29.	Water wks., Melrose, Minn.	Jun. 24
Jun. 30.	Pumps, etc., Toledo, O. Adv. Jun. 3 to 17.	Jun. 3
Jun. 30.	Water wks., Mt. Olive, Ill. Adv. Jun. 17.	Jun. 17
Jun. 30.	Pipe, Kansas City, Mo.	Jun. 17
Jun. 30.	Water wks., Lumberton, N. J. Adv. Jun. 24.	Jun. 24
Jun. 30.	Mains, Eldora, Ia.	Jun. 24
Jun. —.	**Prescott, Wash.**	Apr. 1
Jun. —.	Alma, Wash.	Apr. 22
Jun. —.	Pumps, etc., Richland, Ga.	Apr. 22
Jun. —.	**Pipe, etc., Thibodaux, La.**	Apr. 22
Jul. 1.	Water works, Winside, Neb.	Jun. 3
Jul. 1.	Cottage Grove, Ore.	Jun. 10
Jul. 3.	Reservoir, Winnipeg, Man. Adv. Jun. 3 to 17.	Jun. 3
Jul. 5.	C. i. pipe, etc., Brooklyn, N. Y.	Jun. 24
Jul. 5.	Hydrants, pipe, etc., New York, N. Y.,	Jun. 24
Jul. 5.	Mains, Spokane, Wash.	Jun. 24
Jul. 5.	C. i. pipe, etc., Columbus, O.	Jun. 24
Jul. 10.	Pipe, etc., Panama	Jun. 17
Jul. 11.	System, Tama, Ia.	Jun. 24
Jul. 17.	Bishopville, S. C. Adv. June 3 to 24.	Jun. 3
Jul. 17.	Valves, pipe, etc., Panama Adv. Jun. 17 to 24.	Jun. 17
Jul. 18.	System, Wahpeton, N. D.	Jun. 17
Jul. 18.	Mains and reservoir, Havre, Mont. Adv. Jun. 24.	Jun. 24
Jul. 19.	Pumps and engines, Panama Adv. Jun. 24.	Jun. 24
Jul. 29.	Pumps, Brooklyn, N. Y.	Jun. 24
Jul. —.	Water wks., Morehead City, N. C.	Jun. 17
Aug. 17.	Irrigation, Yuma, Ariz. Adv. Jun. 17, 24.	Jun. 17

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Jun. 27.	Cleveland Heights, O.	Jun. 3
Jun. 27.	Greensburg, Ind. Adv. Jun. 10, 17.	Jun. 10
Jun. 27.	Binghamton, N. Y.	Jun. 17
Jun. 27.	Trenton, N. J.	Jun. 24
Jun. 28.	Quitman, Ga. Adv. Jun. 17 to 24.	Jun. 17
Jun. 28.	Brooklyn, N. Y.	Jun. 17
Jun. 28.	New York, N. Y.	Jun. 24
Jun. 29.	South Milwaukee, Wis.	Jun. 17
Jun. 29.	Janesville, Wis.	Jun. 24
Jun. 29.	La Grange Park, Ill.	Jun. 24
Jun. —.	Sacramento, Cal.	May 13
Jul. 1.	Morgantown, N. C.	Jun. 3
Jul. 1.	St. Charles, Mo.	Jun. 17
Jul. 1.	Bridgeport, Conn. Adv. Jun. 17 to 24.	Jun. 17
Jul. 1.	Mobile, Ala.	Jun. 24
Jul. 1.	Chillicothe, O.	Jun. 24
Jul. 3.	Brainerd, Minn.	Jun. 10
Jul. 3.	Gettysburg, Pa. Adv. Jun. 17 to 24.	Jun. 17
Jul. 5.	Cincinnati, O.	Jun. 17
Jul. 7.	Abilene, Kan.	Jun. 17
Jul. 8.	Macon, Ga.	Jun. 24
Jul. 12.	Mamaroneck, N. Y.	Jun. 24
Jul. 17.	Groton, S. D.	Jun. 24
Jul. 17.	Westfield, Mass. Adv. Jun. 24.	Jun. 24
Jul. 18.	Wahpeton, N. D.	Jun. 17
Jul. 21.	Utica, N. Y. Adv. Jun. 17 to 24.	Jun. 17
Aug. 1.	Toronto, Ont.	Jun. 17
Aug. 5.	Alliance, O.	Jun. 24

BRIDGES.

Bids Close.		See Eng. Record.
Jun. 27.	Emrichsville, Ind.	Jun. 17
Jun. 27.	Ebensburg, Pa.	Jun. 24
Jun. 27.	Trenton, N. J.	Jun. 24
Jun. 28.	Tiverton, R. I. Adv. Jun. 3 to 24.	Jun. 3
Jun. 28.	Ft. Wayne, Ind.	Jun. 24
Jun. 28.	Peoria, Ill.	Jun. 24
Jun. 29.	Crysler, Ont.	Jun. 24
Jun. 29.	Lima, O.	Jun. 24
Jun. 29.	Paterson, N. J. Adv. Jun. 24.	Jun. 24
Jun. 29.	West Chester, Pa.	Jun. 24
Jun. 29.	Casper, Wyo.	Jun. 24
Jun. 30.	Reading, Pa.	Jun. 24
Jul. 3.	Natchitoches, La.	Jun. 10
Jul. 3.	Lawrence, Kan.	Jun. 24
Jul. 3.	Minot, N. D.	Jun. 24
Jul. 5.	Tillamook, Ore.	May 27
Jul. 5.	Vale, Ore	Jun. 3
Jul. 5.	Fossil, Ore.	Jun. 17
Jul. 5.	Jacksonville, Fla.	Jun. 24
Jul. 5.	Martinsville, Ind.	Jun. 24
Jul. 5.	Spartanburg, S. C.	Jun. 24
Jul. 6.	Redding, Cal.	May 27
Jul. 6.	Lawrenceville, Ga.	Jun. 3
Jul. 6.	Pikeville, Ky.	Jun. 24
Jul. 6.	Weaverville, Cal.	Jun. 24
Jul. 7.	Baltimore, Md.	Jun. 17
Jul. 8.	Portland, Me. Adv. Jun. 17 to 24.	Jun. 17
Jul. 8.	Terre Haute, Ind.	Jun. 17
Jul. 10.	Drury, Kan.	Jun. 24
Jul. 10.	Port Clinton, O.	Jun. 24
Jul. 11.	Castlewood, S. D.	Jun. 10
Jul. 11.	Wabasha, Minn.	Jun. 17
Jul. 14.	Owen Sound, Ont. Adv. June 24	Jun. 24

PAVING AND ROADMAKING.

Bids Close.		See Eng. Record.
Jun. 27.	Boise, Idaho	Jun. 10
Jun. 27.	Pottstown, Pa. Adv. Jun. 17 to 24.	Jun. 17
Jun. 27.	New Brighton, S. I., N. Y.	Jun. 17
Jun. 27.	Cleveland, O.	Jun. 24
Jun. 27.	Dayton, O.	Jun. 24
Jun. 27.	Chicago, Ill.	Jun. 24
Jun. 28.	Cincinnati, O.	Jun. 10
Jun. 28.	Portsmouth, O.	Jun. 10
Jun. 28.	New Brunswick, N. J.	Jun. 10
Jun. 28.	Ft. Moultrie, S. C.	Jun. 24
Jun. 28.	Providence, R. I.	Jun. 24
Jun. 28.	New York, N. Y.	Jun. 24
Jun. 29.	New York, N. Y.	Jun. 17
Jun. 29.	Lynn, Mass.	Jun. 24
Jun. 29.	Crawfordsvlle, Ind.	Jun. 24
Jun. 29.	Toledo, O.	Jun. 24
Jun. 29.	Towson, Md.	Jun. 24
Jun. 30.	Morris, Conn.	Jun. 24
Jun. 30.	Farmington, Conn.	Jun. 24
Jun. 30.	Paterson, N. J.	Jun. 24
Jun. —.	**Council Bluffs, Ia.**	May 20
Jul. 1.	Cleveland, O.	Jun. 10
Jul. 1.	Trinidad, Col. Adv. Jun. 17 to 24.	Jun. 17
Jul. 1.	Helena, Ark.	Jun. 17
Jul. 1.	Chillicothe, O.	Jun. 24
Jul. 1.	Tiverton, R. I.	Jun. 24
Jul. 3.	Greencastle, Ind.	Jun. 17
Jul. 3.	Lawrence, Kan.	Jun. 24
Jul. 3.	Vernon, Ind.	Jun. 24
Jul. 3.	Trenton, N. J.	Jun. 24
Jul. 3.	Perth Amboy, N. J.	Jun. 24
Jul. 3.	Woodville, O.	Jun. 24
Jul. 3.	Greensburg, Ind.	Jun. 24
Jul. 5.	Cincinnati, O.	Jun. 17
Jul. 5.	Emlenton, Pa. Adv. Jun. 17.	Jun. 17
Jul. 5.	Gravel road, Mt. Holly, N. J. Adv. Jun. 17 to 24.	Jun. 17
Jul. 5.	Stone road, Mt. Holly, N. J. Adv. Jun. 17 to 24.	Jun. 17
Jul. 5.	Knox, Ind.	Jun. 24
Jul. 5.	Brooklyn, N. Y.	Jan. 24
Jul. 5.	Logansport, Ind.	Jun. 24
Jul. 5.	Paoli, Ind.	Jun. 24
Jul. 7.	Vincennes, Ind.	Jun. 17
Jul. 7.	Des Moines, Ia.	Jun. 24
Jul. 7.	Monroe, Wis.	Jun. 24
Jul. 7.	Clarinda, Ia. Adv. Jun. 24.	Jun. 24
Jul. 8.	Beloit, Wis.	Jun. 17
Jul. 8.	York, Pa.	Jun. 24
Jul. 8.	Beloit, Wis.	Jun. 24
Jul. 11.	Telford road, Mt. Holly, N. J. Adv. Jun. 17 to 24.	Jun. 17
Jul. 11.	Ashland, O.	Jun. 24
Jul. 11.	Cleveland Heights, O.	Jun. 24
Jul. 11.	Peekskill, N. Y.	Jun. 24
Jul. 12.	Freehold, N. J.	Jun. 24
Jul. 20.	Washington, D. C. Adv. Jun. 24.	Jun. 24
Jul. 27.	Xenia, O. Adv. Jun. 24.	Jun. 24
———	Osceola, Ia.	Jun. 24
Aug. 1.	Belvidere, Ill.	May 20

POWER, GAS AND ELECTRICITY.

Bids Close.		See Eng. Record.
Jun. 27.	Washington, D. C.	Jun. 17
Jun. 28.	Ann Arbor, Mich Adv. Jun. 24.	Jun. 24
Jun. 29.	Melrose, Minn.	Jun. 24
Jul. 1.	Philadelphia, Pa.	Jun. 24
Jul. 3.	Ukiah, Cal.	Jun. 10
Jul. 5.	Washington, D. C.	Jun. 24
Jul. 5.	Youngstown, O.	Jun. 24
Jul. 7.	Durant, Miss.	Jun. 3
Jul. 11.	Lincoln, Neb. Adv. Jun. 17 to 24.	Jun. 17
Jul. 15.	Pensacola, Fla.	Jun. 17
Jul. 15.	Kings Mountain, N. C.	Jun. 17
Jul. 18.	Washington, D. C.	Jun. 24
Jul —.	Morehead City, N. C.	Jun. 17
Aug. 15.	Campbellsville, Ky.	Jun. 24

BUILDINGS.

Bids Close.		See Eng. Record.
Jun. 27.	Library, Cincinnati, O.	Jun. 3
Jun. 27.	Post-Office, Grand Forks, N. D.	Jun. 10
Jun. 27.	Vent. and htg. school, Los Angeles, Cal.	Jun. 10
Jun. 27.	School, Montclair, N. J. Adv. Jun. 10, 17.	Jun. 10
Jun. 27.	Pub. bldgs., New Brighton, S. I., N. Y.	Jun. 17
Jun. 28.	School, Agriculture College, Mich	Jun. 10
Jun. 28.	P. O. Bldg., Westchester, Pa.	May 27
Jun. 28.	Htg. court house, Shelbyville, Ind.	Jun. 10
Jun. 28.	Pub. Bldgs., Binghamton, N. Y.	Jun. 10
Jun. 28.	Jail, Newport, Ark.	Jun. 24
Jun. 28.	Pub. bldgs., Indianapolis, Ind.	Jun. 24
Jun. 29.	Schools, etc., Indianapolis, Ind.	Jun. 17
Jun. 29.	School, Vandalia, Mo.	Jun. 17
Jun. 29.	Hospital, Wash., D. C., Adv. Jun. 3 to 24	Jun. 3
Jun. 29.	Exten. work, Senate Bldg., Washington, D. C.	Jun. 10
Jun. 29.	Shelters, Brooklyn, N. Y.	Jun. 17
Jun. 29.	Shelter, Cleveland, O.	Jun. 24
Jun. 29.	School, Zanesville, O.	Jun. 24
Jun. 30.	Lodge, Diamond, Ind.	Jun. 3
Jun. 30.	City Hall, etc., Ida Grove, Ia.	Jun. 17
Jun. 30.	Light Sta., Portland, Ore.	Jun. 17
Jun. 30.	School, Steubenville, O.	Jun. 24
Jun. 30.	School, Dublin, Ga.	Jun. 24
Jun. —.	**School plans, Stillwater, Okla. Ter.**	May 20
Jul. 1.	Bus. bldg., Atlantic City, N. J.	Jun. 10
Jul. 1.	Pub. Bldg., Washington, D. C. Adv. May 27 to Jun. 24.	May 27
Jul. 1.	**Pub. Bldg., Baltimore, Md.**	May 20
Jul. 1.	Court House, Wallace, Idaho	Jun. 3
Jul. 1.	Bus. bldgs., Liberty, a	Jun. 17
Jul. 1.	Court house, Globe, Ariz.	Jun. 24
Jul. 1.	Bus. bldg., Idaho Falls, Idaho	Jun. 24
Jul. 3.	School, East Liverpool, O.	Jun. 17
Jul. 3.	School, Albany, N. Y.	Jun. 17
Jul. 3.	Plan for courthouse, Westville, Miss.,	Jun. 24
Jul. 3.	Pub. Bldgs., Bath, N. Y.	Jun. 24
Jul. 5.	Pub. Bldg. plans, Springfield, Mass.	Jun. 10
Jul. 5.	Court House plans, **Montgomery, Ala.**	May 27
Jul. 5.	Pub. bldgs., National Military Home, O.	Jun. 17
Jul. 5.	Pub. Bldgs., New York, N. Y.	Jun. 24
Jul. 5.	Hospital, Monson, Mass.	Jun. 24
Jul. 5.	School, New York, N. Y.	Jun. 24
Jul. 6.	Hospital, Dunlaps, Ia.	Jun. 3
Jul. 6.	School, Cleveland Heights, O.	Jun. 10
Jul. 6.	Pub. Bldg., St. James, Mo.	Jun. 24
Jul. 6.	Hotel Charlotte, N. C.	Jun. 24
Jul. 6.	School, La Crosse, Wis.	Jun. 24
Jul. 7.	Metal work, Light Sta., Phila., Pa. Adv. Jun. 10, 17.	Jun. 10
Jul. 7.	School, East Palestine, O.	Jun. 24
Jul. 10.	School, Cleveland, O.	Jun. 17
Jul. 10.	Courthouse, Wallace, Idaho	Jun. 24
Jul. 11.	Hospital, Goshen, Ind.	Jun. 10
Jul. 12.	Htg. court house, Cambridge, Minn.,	Jun. 10
Jul. 12.	P. O. Bldg., Deadwood, S. D. Adv. Jun. 17 to 24.	Jun. 17
Jul. 12.	Hospital, New York, N. Y.	Jun. 24
Jul. 13.	Pub. Bldg. Albion, N. Y.	Jun. 24
Jul. 15.	Hotel, Little Rock, Ark.	Jun. 17
Jul. 15.	Jail, Ladysmith, Wis.	Jun. 24
Jul. 17.	Post bldg., Ft. Warren, Mass. Adv. Jun. 24.	Jan. 24
Jul. 18.	Schools, Wahpeton, N. D.	Jun. 17
Jul. 20.	Custom House, San Francisco, Cal.	Jun. 3
Jul. 22.	Hospital, New Orleans, La.	Jun. 17
Jul. 24.	P. O. Bldg., Fargo, N. D.	Jun. 17
Jul. 24.	P. O. Bldg., Muncie, Ind. Adv. Jun. 24.	Jun. 24
Jul. 26.	P. O. Bldg., Spartansburg, S. C. Adv. Jun. 24.	Jun. 24
Jul. 30.	Court House improv., Leesville, La.	May 13
Aug. 1.	**Y. M. C. A. Bldg., Spokane, Wash.**	Apr. 29
Aug. 9.	Pub. bldgs., Chicago, Ill.	Jun. 17
———	Schools, North Providence, R. I.	Jun. 17
———	School, Phoenix, Ariz.	Jun. 24
———	Remodeling Court House, Taylorville, Ky.	Jun. 24

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Jun. 27.	Dredging, Boston, Mass. Adv. Jun. 3 to 24	Jun. 3
Jun. 27.	Dredging, Duluth, Minn. Adv. Jun. 3 to 24.	Jun. 3
Jun. 27.	Supplies, Washington, D. C.	Jun. 10
Jun. 27.	Supplies, Washington, D. C.	Jun. 17
Jun. 27.	Drainage works, Cornwall Centre, Ont.	Jun. 17
Jun. 27.	Park Work, Newark, N. J.	Jun. 24
Jun. 27.	R. R. work, Philadelphia, Pa.	Jun. 24
Jun. 27.	Dike, etc., Boston, Mass.	Jun. 24
Jun. 28.	Jetty Work, Galveston, Tex. Adv. Jun. 3 to 24.	Jun. 3
Jun. 28.	Brook improv., Newton, Mass.	Jun. 24
Jun. 29.	Dredging, Prophetstown, Ill.	Jun. 10
Jun. 29.	Wall, etc., New York, N. Y.	Jun. 17
Jun. 29.	Park work, New York, N. Y.	Jun. 24
Jun. 30.	Dredging, York, Me. Adv. Jun. 3 to 24.	Jun. 3
Jun. 30.	Dredging, Savannah, Ga. Adv. Jun. 3 to 24.	Jun. 3
Jun. 30.	Cement, Cincinnati, O.	Jun. 10
Jun. —.	Subway, Memphis, Tenn.	May 13
Jul 1.	**Municipal St. Ry. system, Chicago, Ill.**	Apr. 15
Jul. 1.	Dredge, Chicago, Ill.	Jun. 3
Jul. 1.	Dredging, Jacksonville, Fla. Adv. Jun. 3 to 24.	Jun. 3
Jul. 1.	Dredging, Montgomery, Ala. Adv. Jun. 10 to 24.	Jun. 10
Jul. 1.	Dredging, Philadelphia, Pa.	Jun. 17
Jul. 1.	El. Ry. Work, Mobile, Ala	Jun 24
Jul. 3.	Dredging, etc., Norfolk, Va. Adv. Jun. 10 to 24.	Jun. 10
Jul. 3.	Dam, etc., Mobile, Ala. Adv. Jun. 3 to 24.	Jun. 10
Jul. 3.	Bear-trap gates, Pittsburg, Pa. Adv. Jun. 3 to 24.	Jun. 3
Jul. 5.	Dredging, Baltimore, Md. Adv. Jun. 3 to 24.	Jun. 10
Jul. 5.	Rock, etc., New Orleans, La.	Jun. 17
Jul. 5.	Searchlight outfits, Wash., D. C. Adv. Jun. 24.	Jun. 24
Jul. 6.	Jetty work, Wilmington, Del. Adv. Jun. 10 to 24.	Jun. 10
Jul. 6.	Dredging, Wilmington, Del.	Jun. 17
Jul. 6.	Gravel, Brooklyn, N. Y.	Jun. 24
Jul. 7.	Conduit, Chicago, Ill. Adv. Jun. 17 to 24.	Jun. 17
Jul. 7.	El. Ry. work, Baltimore, Md.	Jun. 17
Jul. 8.	Jetty work, Block Island, R. I. Adv. Jun. 17 to 24.	Jun. 17
Jul. 8.	Dredging, Block Island, R. I. Adv. Jun. 17 to 24.	Jun. 17
Jul. 10.	Boiler, Wilmington, N. C. Adv. Jun. 17 to 24.	Jun. 17
Jul. 12.	Dredging, Portland, Me. Adv. Jun. 10 to 24.	Jun. 17
Jul. 12.	Dredging, etc., Jacksonville, Fla. Adv. Jun. 17, 24.	Jun. 17
Jul. 14.	Dredging, Boston, Mass.	Jun. 17
Jul. 14.	Dredging, Mobile, Ala. Adv. Jun. 17, 24.	Jun. 17
Jul. 15.	Storage plant, etc., Pensacola, Fla.	Jun. 17
Jul. 17.	Wire, etc., Memphis, Tenn. Adv. Jun. 24.	Jun. 24
Jul. 17.	Dredging, Philadelphia, Pa. Adv. Jun. 17, 24.	Jun. 17
Jul. 18.	Supplies, Washington, D. C.	Jun. 24
Jul. 20.	Dredging, Honolulu, H. I. Adv. Jun. 24.	Jun. 24
Jul. 20.	Rem. of wreck, Charleston, S. C. Adv. Jun. 24.	Jun. 24
Jul. 21.	Mchy. for lock, Pittsburg, Pa.	Jun. 24
Jul. 24.	Destructor, Panama Adv. Jun. 24.	Jun. 24
Jul. 29.	Dredging, etc., Bremerton, Wash.	Jun. 24
Jul. 31.	R. R. work, Miami, Fla. Adv. Jun. 24.	Jun. 24
Jul. 3.	Garb. Disp., Port Chester, N. Y.	Jun. 24
Aug. 9.	Dock, Chicago, Ill.	Jun. 17
Aug. 26.	Coal plant, Olongapo, P. I.	May 6
Sep. 1.	Steel and iron, Sydney, N. S. Wales Adv. Apr. 8, 22; May 6, 20; Jun. 3, 17.	Apr. 8
Nov. 1.	R. R. work, Manila, P. I.	Jun. 17
Apr. 2,	'06. Harbor Work, Valparaiso, Chili, Adv. Apr. 29 to Jun. 24.	Apr. 29

Items marked thus give the names of parties awarded contracts.